

PAPER – 6A : INFORMATION TECHNOLOGY

QUESTIONS

1. Define the following terms briefly:

(i) Clock Speed	(ii) BIOS	(iii) Parallel Port
(iv) Throughput	(v) Flash memory	(vi) FAT
(vii) Smart Terminal	(viii) E-mail	(ix) ASCII
(x) Candidate Key	(xi) Mirror Log	(xii) Repeaters
(xiii) Half Duplex	(xiv) Web server	(xv) FTP
(xvi) ATM	(xvii) Cyber Cash	(xviii) Firewall
(xix) Console	(xx) Data Dictionary	(xxi) Integrated Circuit (IC)
(xxii) Parity Checks	(xxiii) Semi Conductor	(xxiv) System
(xxv) Overlay.		
2. Differentiate between the following:
 - (i) Micro-Computer and Workstation
 - (ii) Static RAM and Dynamic RAM
 - (iii) CRT and Flat Panel
 - (iv) MICR and OCR
 - (v) CD-ROM Disk and DVD
 - (vi) Ink Jet Printer and Laser Printer
 - (vii) Multiprogramming and Multiprocessing
 - (viii) Sequential File and Direct File
 - (ix) Hierarchical Database and Network Database
 - (x) Distributed Database and Object Oriented Database
 - (xi) Client Server and Peer-to-Peer
 - (xii) Ring Topology and Mesh Topology
 - (xiii) Synchronous and Asynchronous Transmission
 - (xiv) Intranet and Extranet
 - (xv) Flowchart and Decision Table.
3. Convert the following from one number system to another number system along with the working notes:
 - (i) $(2158)_{10} = ()_2$
 - (ii) $(10110111)_2 = ()_{10}$
 - (iii) $(527.25)_{10} = ()_2$
 - (iv) $(11101101.110)_2 = ()_{10}$
4.
 - (a) Describe in detail various generations of computers.
 - (b) Draw the schematic diagram of a computer. Briefly discuss each of the components covered in it.
5.
 - (a) What are the advantages and disadvantages of Direct Access Storage?
 - (b) What is Magnetic Disk? How the data is stored on a Magnetic Disk?

6. (a) Describe the various input devices used to input and capture the data.
(b) Describe in brief the methods of producing computer output.
7. (a) What is "Software"? Describe the various types of softwares in brief.
(b) What is an Operating System? Discuss its various functions in brief.
(c) Explain the components of a Decision Support System.
8. (a) What is Database Management System? Describe various management problems of File Processing that can be eliminated using DBMS.
(b) What are the roles and responsibilities of Database Administrator?
9. (a) Describe in brief the different types of database used to store the data.
(b) Describe the various phases used to process the data in Data warehousing and Data mining.
10. (a) What is Data Communication? Discuss various types of networks in brief.
(b) What is Transmission Protocol? Discuss various Transmission Techniques in brief.
11. (a) Discuss the various components of Client Server Technology.
(b) What is Data Centre? Discuss the challenges faced by the management in establishing the Data Centre.
(c) What are the network Threats and Vulnerabilities?
12. (a) Describe any ten benefits offered by E-commerce applications.
(b) What is Supply Chain Management (SCM)? Discuss the broad areas where the SCM can be implemented.
(c) Discuss the advantages of EDI in brief.
13. Draw a flow chart to compute and print income-tax and surcharge on the income of a person, where income is to be read from terminal and tax is to be calculated as per the following rates :

Upto Rs. 40,000	No tax
Upto Rs. 60,000	@ 10% of amount above Rs. 40,000
Upto Rs. 1,50,000	Rs. 2,000 + 20% of amount above Rs. 60,000
Above Rs. 1,50,000	Rs. 20,000 + 30% of amount above Rs. 1,50,000

Add surcharge @ 2% on the amount of total tax, if the income of a person exceeds Rs. 2,00,000.
14. The details of procedure for dealing with delivery charges for goods bought from ABC Company is given below :

For calculating the delivery charges, customers are divided into two categories, those whose sales region code is 10 or above and those with the code of less than 10.

If the code is less than 10 and the invoice amount is less than Rs. 10,000, the delivery charge to be added to the invoice total is Rs. 200. But if the invoice value is for Rs. 10,000 or more, the delivery charge is Rs. 100.

If the code is equal to or greater than 10, the corresponding delivery charges are Rs. 250 and Rs. 150 respectively.

Prepare a decision table of the above procedure.
15. Write short notes on the following:

(i) Tape Cartridge Systems	(ii) Bar Codes	(iii) Debugging
(iv) SQL	(v) ISDN	(vi) WWW
(vii) E-mail	(viii) Credit Cards	(ix) Wi-Fi Technology.

SUGGESTED ANSWERS/HINTS

1. Define the following terms briefly:

- (i) **Clock Speed:** The clock speed is the speed at which the processor executes instructions. Clock speed is measured in megahertz (MHz)—which is a million cycles per second. Therefore, a 450 MHz processor performs 450 million instructions per second. Higher the clock's speed, the faster the processor, the better the system performance.
- (ii) **BIOS:** BIOS stands for Basic Input Output System—a small chip on the motherboard that loads the hardware settings required to load various devices like keyboards, monitors, or disk drives.
- (iii) **Parallel ports:** Parallel ports are used to connect external input/output devices like scanners or printers. Parallel ports facilitate the parallel transmission of data, usually one byte (8 bits) at a time. Parallel ports use 25 pin RS-232C.
- (iv) **Throughput:** It is the rate at which information can be read from or written to the storage. In computer storage, throughput is usually expressed in terms of megabytes per second or MBs, though bit rate may also be used. As with latency, read rate and write rate may need to be differentiated.
- (v) **Flash memory:** Flash memory chips, a form of static RAM (SRAM) chips, store data much like those used in the computer's primary storage. However, the data stays recorded even when the power is turned off. Flash memory is non-volatile and very fast.
- (vi) **The File-Allocation Table (FAT):** It 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.
- (vii) **Smart Terminal:** It contains a microprocessor and some internal storage. It has data editing capability and can consolidate input data before sending it to CPU. These terminals are non-programmable by users.
- (viii) **Electronic Mail:** Abbreviated as e-mail or e-Mail or email, it is a method of composing, sending, storing, and receiving messages over electronic communication systems. The term e-mail applies both to the Internet e-mail system based on the Simple Mail Transfer Protocol (SMTP) and to intranet systems allowing users within one company to send e-mail to each other.
- (ix) **ASCII:** It stands for American Standard Code for Information Interchange. ASCII code is used extensively in small computers, peripherals, instruments and communications devices. It is a seven-bit code. It includes upper and lower case alphabets, numbers, punctuation mark and special and control characters.
- (x) **Candidate Key:** It is any set of one or more columns whose combined values are unique among all occurrences (i.e., tuples or rows). Since a null value is not guaranteed to be unique, no component of a candidate key is allowed to be null.
- (xi) **Mirror Log:** It 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) **Repeaters:** These are devices that solve the snag of signal degradation which results as data is transmitted along the various cables. The repeater boosts or amplifies the signal before passing it through to the next section of cable.
- (xiii) **Half Duplex:** In this mode, data can be transmitted back and forth between two stations, but data can only go in one of the two directions at any given point of point.

- (xiv) Web Server: A computer program that is responsible for accepting HTTP requests from clients, which are known as web browsers, and serving them HTTP responses along with optional data contents, which usually are web pages such as HTML documents and linked objects (images, etc.).
 - (xv) FTP: FTP or File Transfer Protocol is an Internet-wide standard for distribution of files from one computer to another. The computer that stores files and makes them available to others is server. Client software is used to retrieve the files from the server.
 - (xvi) Automated Teller Machines (ATMs): Consumers can do their banking without the assistance of a teller, to get cash, or to make deposits, pay bills, or transfer funds from one account to another electronically. These machines are used with a debit or EFT card and a code, which is often called a personal identification number or "PIN."
 - (xvii) Cyber Cash: An electronic cheque that has all the same features as a paper cheque. It functions as a message to the sender's bank to transfer funds, and, like a paper cheque, the message is given initially to the receiver who, in turn, endorses the cheque and presents it to the bank to obtain funds.
 - (xviii) Firewalls: 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.
 - (xix) Console: A portion of a computer that is used for communication between operators or maintenance engineers and the computer, usually by means of displays and manual control.
 - (xx) Data Dictionary: A document listing and defining all items or processes represented in data flow diagrams or used within a system.
 - (xxi) Integrated Circuit (IC): A device incorporating circuitry and semiconductor components within a single unit, usually a miniature chip. Circuit elements and components are created as part of the same manufacturing procedures.
 - (xxii) Parity Checks: A check that tests whether the number of 1-bits in an array is either even ("even parity check") or odd ("odd parity check").
 - (xxiii) Semiconductor: It refers to material with electrical conducting qualities that fall between those of conductors and resistors. Also refers to electronic components and devices using semiconductor materials treated to impart special electrical properties.
 - (xxiv) System: It is a set or arrangement of entities that forms, or is considered as an organized whole. It is applied to both hardware and software entities; therefore it must be carefully qualified to be meaningful e.g., computer system, management information system, number system, operating system.
 - (xxv) Overlay: It is a technique to transfer segment of program from auxiliary storage into internal storage for execution. Overlay makes it possible to execute programs which are too large to fit into the computer internal storage at one time. It is also important in multi-programming and time-sharing operations.
2. (i) Micro-computer, is a full-fledged computer system that uses a microprocessor as its CPU. These are also called personal computers. Between minicomputer and microcomputer, in terms of processing power, there is a class of computers known as workstation. It looks like a personal computer and is typically used by one person. Most microcomputers can run on DOS, Windows and Windows NT operating system

Workstations, differ significantly from microcomputers in two areas. Internally, workstations are constructed differently than microcomputers. They are based on different architecture of CPU called Reduced Instruction Set Computing (RISC) which results in faster processing of instructions compared to microprocessor based personal computers. Workstations are

generally used by scientists and engineers. Workstations generally run on the Unix operating system or a variation of it. Although workstations are still more powerful than the average personal computer, the difference in the capabilities of these types of machines are growing smaller.

- (ii) Static RAM (SRAM), is like DRAM but it's a lot faster, larger, and more expensive. It's static because it doesn't need to be continually refreshed. Because of its speed, SRAM is used mainly in a special area of memory called a cache. The Static RAM retains the stored data as long as the power remains in, whereas with dynamic RAM, the stored information disappears after a few milliseconds have elapsed. The power consumption of a dynamic RAM is less than that of a static RAM, which has the advantage of making a higher degree of integration possible.

Dynamic RAM (DRAM), is the most common type of main memory. It is dynamic because each memory cell quickly loses its charge so it must be refreshed hundreds of times each second to prevent data from being lost.

- (iii) Cathode ray tube (CRT), devices use a large tube-type element that looks like the picture tube in a standard TV set. Inside the tube is a gun that lights up the phosphorescent pixels on the screen surface. CRT technology is relatively inexpensive and reliable. CRT-type display devices are rather bulky and limited in the resolution that they provide.

Flat-Panel, display is uses either a liquid crystal display (LCD) or gas-plasma technology. To form images, LCD devices use crystalline materials sandwiched between two panes of glass. When heat or voltage is applied, the crystals line up. This prevents light from passing through certain areas and produces the display. Gas-plasma displays, which provide better resolution but are more expensive than liquid crystal displays, use gas trapped between glass to form images. The biggest advantage of flat-panel displays is that they are lightweight and compact. This makes them especially useful for laptop, notebook, and pocket personal computers.

- (iv) Magnetic Ink Character Recognition (MICR), employs a system of printed characters which are easily decipherable by human beings as well as a machine reader. It also uses special printing fonts to represent characters. In this font, each character is basically composed of vertical bars. The characters are printed in special ink, which contains a magnetizable material. 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.

Optical Character Reading (OCR), employs a set of printing characters with standard font that can be read by both human and machine readers. The machine reading is done by light scanning techniques in which each character is illuminated by a light source and the reflected image of the character is analysed in terms of the light-dark pattern produced. Optical character readers can read upper and lower case letters, numerics and certain special characters from handwritten, typed and printed paper documents. Large volume billing applications (e.g. the bills of utility companies, credit-card organisations, 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.

- (v) CD-ROM, is a spinoff of audio CD technology and stands for compact-disk-read-only memory. CD-ROM disks are created as a mastering facility. The master copy is duplicated or "pressed" at the factory and copies are distributed with their pre-recorded contents. Once inserted into the CD-ROM disk drive, the text, video images, and so on can be read into primary storage for processing or display. However, the data on the disk are fixed, they can not be altered. The capacity of a single CD-ROM is over 650 MB which is equivalent to 250,000 pages of text, or 1500 floppy disks. The tremendous storage capacity has opened

the door to a variety of multimedia applications. Unlike a video tape, CD-ROM gives the presenter instant random access to any sequence of images on the disk.

DVD (also known as "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. A video disk can store text, video, and audio data. Video disks can be accessed a frame at a time (to provide still information) or played like a phonograph record (to supply up to an hour of moving action) A digital video disk (DVD) is a 5 inch plastic disk that uses a laser to encode microscopic pits in its substrate surface. But the pits on a DVD are much smaller and are encoded much closer together than those on a CD-ROM. The advantages of DVDs are therefore self-evident – a huge storage capacity that enables users to archive large amounts of data on a single, lightweight, removable, reliable, easily-transportable medium. Video disk systems were developed to help real estate agents conduct better searches for homes and properties for their clients. Video disks are widely used for training applications. Video disks are also used by automobile manufacturers to show their lines and by travel agents to interest clients in resorts.

- (vi) Ink-Jet Printers, utilize the dot matrix principle but in stead of pins, set mechanically to form a character. It uses an array of nozzles which spray jets of ink onto the paper. Ink jet printers are available in the market at fairly reasonable prices.

Laser Printer, uses a combined system which utilizes laser and Xerographic photocopying technology. In a laser printer, a beam from a small laser scans horizontally across a charged xerographic selenium drum to build up an invisible electrostatic image of a whole page of text. Laser printer produces not only alphanumeric characters but also drawings, graphics and other requirements. Its output can be very close to professional printing quality.

- (vii) Multiprogramming, is defined as execution of two or more programs that all reside in primarily storage. Since CPU can execute only one instruction at a time, it cannot simultaneously execute instructions from two or more programs. However, it can execute instruction from one program then from second program and so on. This type of processing is referred to as concurrent execution. It is very useful as most of the time, CPU remains idle waiting for I / O devices to complete their job, as I / O devices are very slow. When I/O devices are working for one program, CPU executes instructions of second program. Thus, multiprogramming is a technique which helps in utilising a computer system more effectively. It is a module, which is available in an operating system.

Multiprocessing, on other hand, refers to the use of two or more central processing units linked together to perform coordinated work simultaneously. Instructions are executed simultaneously because the available CPUs can execute different instructions of the same program or of different programs at any give time. It is also called parallel processing and job can be processed more rapidly than on a single machine. Multiprocessing offers data processing capabilities that are not available when only one CPU is used. Many complex operations can be performed at the same time. Multiprocessing is used for nation's control applications such as rail, road control, airways and traffic control etc.

- (viii) In Sequential File organization, all records are arranged in ascending or descending order by a record key. To locate an individual record, a sequential search from the first record on the file must be performed. Each individual record must be examined until the required record is located. Such a search can be time consuming. Therefore, sequential organisation is impractical for an application that requires immediate access to individual records. On the other hand, sequential organisation would be good for payroll system that is run on a batch basis and every record on the master file being accessed.

Direct file organization, allows immediate direct access to individual records on the file. The direct access storage devices (DASD) have the capability of directly reaching any location. Although there are several types of direct storage devices including discs and other mass storage devices, discs are by far the most widely used direct access storage devices

- (ix) In Hierarchical Database Structure, records are logically organised into a hierarchy of relationships. A hierarchically structured database is arranged logically in an inverted tree pattern. All records in hierarchy are called nodes. Each node is related to the others in a parent-child relationship. Each parent record may have one or more child records, but no child record may have more than one parent record. Thus, the hierarchical data structure implements one-to-one and one-to-many relationships. The top parent record in the hierarchy is called the root record.

Network Database Structure, views all records in sets. Each set is composed of an owner record and one or more member records. This is analogous to the hierarchy's parent-children relationship. Thus, the network model implements the one-to-one and the one-to-many record structures. Unlike the hierarchical mode, the network model also permits a record to be a member of more than one set at one time. The network model allows us to represent one-to-one, one-to-many and many-to-many relationships. The network model also allows us to create owner records without member records. Unlike hierarchical data structures that require specific entrance points to find records in a hierarchy, network data structures can be entered and traversed more flexibly. However, like the hierarchical data model, the network model requires that record relationships be established in advance because these relationships are physically implemented by the DBMS when allocating storage space on disk.

- (x) Distributed Databases, employs the processing is distributed, hence, the data to be processed must be located at the processing site. This means that the database or parts of the database must be distributed. Distributed database systems usually reduce costs for an organization because they reduce transfer of data between remote sites and the organization headquarters. Distributed database systems may also provide organizations with faster response times for filling orders, answering customer requests or providing managers with information. However, distributed systems sometimes compound the problem of control over the database, increase problems of security, increase data redundancy resulting in danger to data integrity.

Object Oriented Database, is based on the concept that the world can be modeled in terms of objects and their interactions. Objects are entities conveying some meaning for us and possess certain attributes to characterize them and interacting with each other. It provides a repository of reusable objects that only need to be created once. This allows new applications to be put together by appropriately arranging the objects stored in the OODB.

(xi)	Client-server model	Peer-to-Peer model
	In this model, number of computers, known as clients are connected to a single host computer known as server.	In this model, all the computers are interconnected with each other. There is no concept of server and clients. All computers behave as server as well as clients.
	It uses a dedicated server which provides various services to clients like hardware, software and data access. Different types of servers can be File, Fax, Print or Database server.	It uses non-dedicated server. Non-dedicated server can also be used as a node for data entry, processing and output operations.
	Clients can share disk storage and printers attached with the server.	All computers can share the data/resources of each other.
	It is suitable for large organizations having large number of nodes.	It is suitable in small organisations having less number of nodes upto ten.
	Data transfer speed is more.	Data transfer speed is less which decreases even further with the increase in number of computers.

Failure of server results in break-down of entire network.

Failure of one computer will not affect the working of other, only the data stored on the faulty computer will not be accessible to other computers.

Server can not be used for data entry/result purposes, hence it can be said that all the computers are not fully employed.

All the computers are fully employed.

Clients are required to be connected with server in a particular structure like Star Network.

Computers can be connected at any convenient point in the network like Ring Network.

Clients can be dumb terminal or Intelligent terminals.

All computers are intelligent terminals.

This architecture is employed where data security is of prime importance.

This architecture is used when security is not a bigger issue.

- (xii) In Ring Topology, 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. These links are unidirectional which ensures that transmission by a node traverses the whole ring and comes back to the node, which made the transmission.

In Mesh Topology, there is a random connection of nodes using communication links. Network lines are expensive to install and maintain. The links are planned to minimize cost and maintain reliable and efficient traffic movement. A mesh network may be fully connected or connected with only partial links. Each node is connected with a dedicated point-to-point link to every node. The reliability is very high as there are always alternate paths available if direct link between two nodes is down or nonfunctional.

- (xiii) In Synchronous Transmission, the bits are transmitted at fixed rate. The transmitter and receiver both use the same clock signals for synchronization. Synchronous transmission allows characters to be sent down the line without start-stop bits. It allows data to be sent as a multi-word blocks. It uses a group of synchronization bits, which is placed at the beginning and at the end of each block to maintain synchronization. Timing is determined by a modem. It is faster way of data transmission and many data words can be transmitted per second. However, the synchronous device is more expensive as it must be smart enough to differentiate between the actual data and the special synchronous characters.

Asynchronous Transmission, each data is accompanied by stop (1) and start (0) bits that identify the beginning and ending of the word. When no information is being transmitted i.e. sender device is idle, the communication line is usually high i.e. there is continuous stream of 1. Asynchronous transmission is a reliable transmission system as the extra start and stop bits ensure that the sender and receiver remain in step with one another. It does not require smart device to differentiate between actual data and start/stop bit. However, it is inefficient as the transmission speed is slowed down when there is huge volume of information to be transmitted.

- (xiv) Intranet, is a type of information system that facilitates communication within the organisation, among widely dispersed departments, divisions and regional locations. Intranets connect people together with Internet technology, using web browsers, web servers and data warehouses in a single view. With an Intranet, access to all information, applications and data can be made available through the same browser. The objective is to organise each individual's desktop with minimal cost, time and effort to be more productive, cost efficient, timely and competitive.

Extranet, is an extension of an Intranet that makes the latter accessible to outside companies or individuals with or without an Intranet. It is also defined as a collaborative

Internet connection with other companies and business partners. Parts of an Intranet are made available to customers or business partners for specific applications. The Extranet is thus an extended Intranet, which isolates business communication from the Internet through secure solutions. Extranets provide the privacy and security of an Intranet while retaining the global reach of the Internet. An Extranet extends the Intranet from one location to another across the Internet by securing data flows using cryptography and authorisation procedures, to another Intranet of a business partner.

- (xv) Flow Chart, is a simple list of the steps that comprise an algorithm which is sufficient for stating the problem in a clear and unambiguous manner. A flowchart is 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.

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. Decision tables are necessitated by the fact that branches of the flowchart multiply at each diamond (comparison symbol) and may easily run into scores and even hundreds. If, therefore, the programmer attempts to draw a flowchart directly, he is liable to miss some of the branches.

3. (i) $(2158)_{10} = (\quad)_2$

2	2158	
2	1079	0
2	539	1
2	269	1
2	134	1
2	67	0
2	33	1
2	16	1
2	8	0
2	4	0
2	2	0
2	1	0
	0	1

$$(2158)_{10} = (100001101110)_2$$

(ii) $(10110111)_2 = (\quad)_{10}$

$$= 1 \times 2^7 + 0 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$= 128 + 0 + 32 + 16 + 0 + 4 + 2 + 1$$

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

(iii) $(527.25)_{10} = (\quad)_2$

To convert the given number from Decimal Number System to Binary Number System, first we will convert mantissa part, then the fractional part into Binary Number System.

Step-I

2	527	
2	263	1
2	131	1
2	65	1
2	32	1
2	16	0
2	8	0
2	4	0
2	2	0
2	1	0
	0	1

$(527)_{10} = (1000001111)_2$

Step – II

$.25 \times 2 = .50$

$.50 \times 2 = 1.0$

So,

$(527.25)_{10} = (1000001111.01)_2$

(iv) $(11101101.110)_2 = (\quad)_{10}$

$= 1 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} + 0 \times 2^{-3}$

$= 128 + 64 + 32 + 0 + 8 + 4 + 0 + 1 + \frac{1}{2} + \frac{1}{4} + 0$

$= (237.75)$

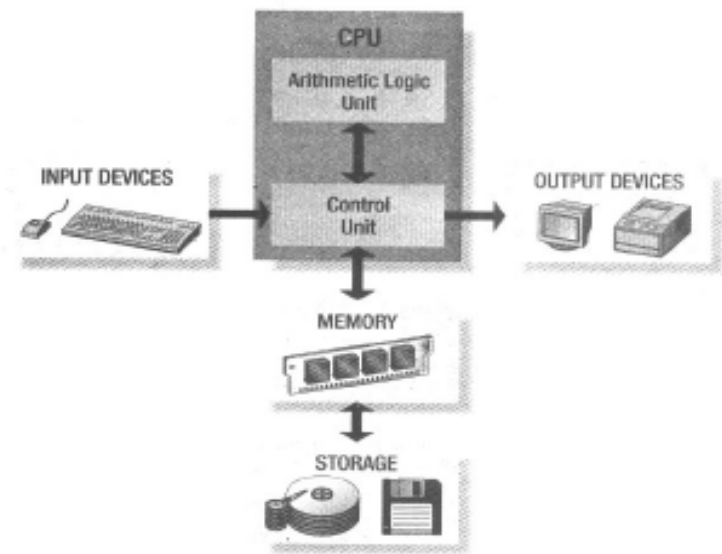
$(11101101.110)_2 = (237.75)_{10}$

4. (a) Generations of computers

Generation	Years	Switching device	Storage device	Switching* device	Software time	Applications
First	1949-55	Vaccum tubes	Acoustic delay lines and later magnetic drum.	0.1 to 1 milli-second	Machine and assembly languages, Simply monitors	Mostly scientific, later simple business systems
Second	1956-65	Transistors	Magnetic core main memory,	1 to 10 micro seconds	High level language. FORTRAN, COBOL, Algol, Batch	Extensive business applications, Engineering design optimization,

					operating systems.	scientific research.
Third	1966-75	Integrated Circuits (IC)	High speed magnetic cores Large disks (100 MB). 1 Mbyte main memory	0.1 to micro second	FORTRAN IV, COBOL 68,PL/1, Time shared operating systems	Data base management systems, online systems
Fourth-First decade	1975-84	Large scale integrated circuits. Micro-processors (LSI)	Semiconductor memory, Winchester disk, 10 Mbyte main memory. 1000 Mbytes disks.	10 to 100	FORTRAN 77, Pascal, ADA, COBOL-74, Concurrent processing	Personal computers. Distributed systems. Integrated CAD/CAM, Real time control, Graphics oriented systems
Fourth-Second decade	1985-present	Very large scale integrated circuits. Over 3 million transistors per chip	Semiconductor memory. 1GB main memory. 100 GB disk	1 to 10 nano-seconds	C, C++, JAVA, PROLOG, Miranda, FP -	Simulation, Visualization, Parallel computing, Virtual reality, Multimedia

(b)



Schematic Diagram of Computer System

The components of this system are called input, processing, output and memory. Each of these units performs specific functions which are enumerated below:

Input: The entry of program statements and data into a computer occurs by means of an input device. Some of the more common input devices are keyboard, floppy disk drives and cartridge tape device.

Central processing unit: The heart of any computer is the central processing unit (CPU). It is this central processor that makes comparisons, performs calculations, reads, interprets and controls the execution of the instructions. It consists of two separate sub-units.

- (1) The control unit;
- (2) The arithmetic and logic unit;

Control Unit: The control unit, as the name implies, supervises the operations of the entire computer. It selects the program statement from the storage unit, interprets the statement and sends the appropriate electronic impulses to the arithmetic/logic and storage units to cause these units to carry out the operations required.

Arithmetic/Logic Unit: Arithmetic and logic unit performs mathematical calculations, compares numeric and non-numeric values and makes decisions. The data flows between this unit and the storage unit during processing. Specifically, data is transferred as needed from the storage unit to the arithmetic/logic unit, manipulated and returned to the storage unit.

Storage: The storage, or primary memory section of the computer consists of the devices used to store the information which will be used during the computations. The storage section of the computer is also used to hold both intermediate and final results as the computer proceeds through the program. Common storage devices are bubble memory, RAM chips etc.

Secondary storage: Because the primary storage capacity of most computers is limited, it is both expensive and not always possible to hold a large volume of data and instructions in the primary storage. Hence, it becomes necessary to have secondary or auxiliary storage for holding data and programs not currently in use. The various secondary storage devices are the magnetic tape drives and magnetic disk drives.

Output devices: Output devices like input units are instruments of communication between people and machines. They are used to record the results obtained by the computer and present them to the outside world. The most commonly used output devices are printers, graph-plotters, magnetic disc drives, visual display unit etc.

5. (a) The advantages of Direct access devices are:
 1. Magnetic rigid disk is a direct access storage medium; therefore, individual records can be retrieved without searching through the entire file.
 2. The costs of disks are steadily declining.
 3. For real-time systems where direct access is required, disks are currently the only practical means of file storage. Other new types of storage, such as bubble storage, are not widely used yet.
 4. Records can be readily updated by writing the new information over the area where the old information was stored.
 5. 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. However, being offline is not a disadvantage for many applications, especially batch applications.
 6. Interrelated files stored on magnetic disk can allow a single transaction to be processed against all of these files simultaneously.

The disadvantages of magnetic disk include:

- . Updating a master file stored on disk destroys the old information. Therefore, disk does not provide an automatic audit trail. When disk is used, back-up and audit trail require that each old master file records be copied to another medium prior to update.
- (b) Magnetic discs are the most popular direct access medium. By direct access we mean that a record can be accessed without having to plod through the preceding records. The other direct access medium is floppy disc. A hard disk is a stack of one or more metal platters that spin on one spindle like a stack of rigid diskettes. Each platter is coated with iron oxides, and the entire unit is encased in a sealed chamber. Unlike diskettes, where the disk and drive are separate, the hard disk and drive is a single unit. It includes the hard disk, the motor that spins the platters, and a set of read/write heads.

How the data is stored in Magnetic Disk

When the new diskettes (or a new hard drive) are purchased, the disks inside are nothing more than simple, coated disks encased in plastic. The disk provides magnetically mapping of the disk space so that the computer can go directly to a specific point on the diskette without searching through data. The process of mapping a diskette is called formatting or initializing. To store the data, formatting a disk is required to create a set of magnetic concentric circles called tracks. The number of tracks on a disk varies with the type (most high-density diskettes have 80). The tracks on a disk do not form a continuous spiral like those on a phonograph record - each one is a separate circle. Most tracks are numbered from the outermost circle to the innermost, starting from zero. Each track on a disk is also split into smaller parts resulting in short segments, or sectors. All the sectors on the disk are numbered in one long sequence, so the computer can access each small area on the disk with a unique number. A sector is the smallest unit with which any disk drive (diskette drive or hard drive) can work. Each bit and byte within a sector can have different values, but the drive can read or write only whole sector at a time. If the computer needs to change just one byte out of 512, it must rewrite the entire sector.

6. (a) The various input devices are:
 - (1) Keyboard: A microcomputer's keyboard is normally its primary input and control device. One can enter data and issue commands via the keyboard. Besides the standard typewriter keyboard, most micro keyboards have function keys, also called soft keys of a document or worksheet that extend past the bottom, top, or sides of the screen. This is known as scrolling. The user can use the up and down arrow keys ($\uparrow\downarrow$) to scroll vertically and the left and right keys ($\leftarrow\rightarrow$) to scroll horizontally.
 - (2) Mouse: The Mouse is a small box, from the bottom of which protrudes a small ball bearing. The ball bearing rotates when the user moves the Mouse across his desk and, as it is linked by cable to the microcomputer, this moves the cursor on the display screen. When the cursor alights on the facility required, the user presses a button on the top of the Mouse and it is activated. A mouse may have one, two or three buttons. A mouse may be classified as a mechanical mouse or an optical mouse, depending on the technology it uses.
 - (3) Touch Screen: An invisible microwave beam 'matrix' criss crosses the screen, emanating from holes along the bottom and sides of the display unit. By pressing the finger against a function or program displayed on the screen, the infrared beam is broken at that intersection and the system activated. Touch screens are used in information-providing systems.
 - (4) Light Pen: A light pen is a pointing device which can be used to select an option by simply pointing at it, or draw figures directly on the screen and move the figures around. A light pen has a photo-detector at its tip. This detector can detect changes in brightness of the screen. When the pen is pointed at a particular point on the screen, it records the instant change in brightness that occurs and informs the computer about

this. Light-pens are useful for menu-based applications. Instead of moving the mouse around or using a keyboard, the user can select an option by pointing at it. A light pen is also useful for drawing graphics in CAD.

- (5) **The Track Ball:** A track ball is a pointing device that works like an upside-down mouse. The user rests his thumb on the exposed ball and his fingers on the buttons. To move the cursor around the screen, the ball is rolled with the thumb. Since the whole device is not moved, a track ball requires less space than a mouse. So when space is limited, a track ball can be a boom. Track balls are particularly popular among users of notebook computers.
- (6) **Joystick:** It is a screen pointing input device. It is a vertical lever usually placed in a ball socket, which can be fitted in any direction to control cursor movements for computer games and for some professional applications.

(b) Various methods of producing computer outputs are :

(1) **Printed Output: Printers**

Printer is one of the most common output devices. It provides the user with a permanent visual record of the data output from the computer. Printers can print on ordinary paper or on specially prepared forms such as dispatch notes, invoices or packing slips. Printers have been developed that are capable of printing from 150 to 2,500 lines per minute, each line consisting of as many as 150 characters. Printers can broadly be subdivided into two categories: impact and non-impact printers. The former are the most common.

(2) **Computer output MICROFILM (microfiche)**

It is an output technique that records output from a computer as microscopic images on roll or sheet film. The images stored on COM are the same images, which would be printed on paper. It reduces characters 24, 42, or 48 times smaller than normal size. The information is then recorded on 16 mm, 35 mm or 105 mm Microfilm.

The data to be recorded is displaced on CRT and a camera takes a picture of it and places it on the film. The film is then processed either in the recorder unit or separately. After it is processed, it can be retrieved and viewed by the user.

(3) **Microphones and Voice Recognition**

Microphones are becoming increasingly important as input devices. Sound is used most often in multimedia, where the presentation can benefit from narration, music, or sound effects. In software, sounds are used to alert the user to a problem or to prompt the user for input. For this type of sound input, basically a digitized recording is required. All that one needs to make such a recording are a microphone (or some other audio input device, such as a CD player) and a sound card that translates the electrical signal from the microphone into a digitized form that the computer can store and process. Sound cards can also translate digitized sounds back into analog signals that can then be sent to the speakers.

Translating voice to text is a capability known as voice recognition (or speech recognition) With it, 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. Even though English uses only about 40 phonemes, a sound can have several different meanings ("two" versus "too," for example) making reliable translation difficult. The challenge for voice recognition system is to distinguish meaningful sounds from background noise.

(4) **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, drum and flat-bed. A drum plotter plots on paper affixed to a drum. The drum revolves back and forth, and a pen suspended from a bar above moves from side-to-side taking up new plot positions or plotting as it moves. This device is suitable for routine graph plotting and also for fashion designs. On a flat-bed plotter, the paper lies flat. The bar on which the pen is suspended itself moves on a gantry to provide the necessary two-way movement. Colour plotting is usually possible.

Plotters are now increasingly being used in application like CAD, which requires high quality graphics on paper. A plotter can be connected to a PC through the parallel port. A plotter is more software dependent than any other peripheral, and needs much more instructions than the printer for producing output.

7. (a) The word “software” has been coined to differentiate between the computer equipment (i.e., the hardware) and the means of controlling the equipment. A software is a collection of programs that perform certain task. There are basically three types of software: Systems software, applications software and general-purpose software.

Systems software: System software is a generic term referring to any computer software which manages and controls the hardware so that application software can perform a task. It is an essential part of the computer system. It comprises of those programs that control and support the computer system and its data processing applications. It includes the following:

Programming languages.

Operating systems.

Subroutines.

Utility programs.

Diagnostic routines.

Language translators.

Application Software: Application software is a subclass of computer software that employs the capabilities of a computer directly to a task that the user wishes to perform. The program usually solves a particular application or problem that is unique to that organisation. Examples of such programs are payroll, General accounting, sales statistics and inventory control etc.

General-purpose software: This software provides the framework for a great number of business, scientific, and personal applications. Spreadsheet, data bases, Computer-Aided Design (CAD) and word processing software etc. fall into this category. Most general-purpose software is sold as a package. The software is accompanied by user-oriented documentation such as reference manuals, keyboard templates, and so on.

For more details of the above points, students are advised to refer to the study material Chapter-1, Unit -3.

- (b) An operating system (OS) is a set of computer programs that manage the hardware and software resources of a computer. An operating system processes raw system and user input and responds by allocating and managing tasks and internal system resources as a service to users and programs of the system. At the foundation of all system software, an operating system performs basic tasks such as controlling and allocating memory, prioritizing system requests, controlling input and output devices, facilitating networking and managing file systems. Most operating systems come with an application that provides an interface to the OS managed resources. These applications have had command line interpreters as a basic user interface, but more recently have been implemented as a graphical user interface (GUI) for ease of operation.

There are six basic functions that an operating system can perform:

- (i) **Schedule Jobs:** They can determine the sequence in which jobs are executed, using priorities established by the organisation.
 - (ii) **Manage Hardware and Software Resources:** They can first cause the user's application program to be executed by loading it into primary storage and then cause the various hardware units to perform as specified by the application.
 - (iii) **Maintain System Security:** They may require users to enter a password - a group of characters that identifies users as being authorised to have access to the system.
 - (iv) **Enable Multiple User Resource Sharing:** They can handle the scheduling and execution of the application programs for many users at the same time, a feature called multiprogramming.
 - (v) **Handle Interrupts:** An interrupt is a technique used by the operating system to temporarily suspend the processing of one program in order to allow another program to be executed. Interrupts are issued when a program requests an operation that does not require the CPU, such as input or output, or when the program exceeds some predetermined time limit.
 - (vi) **Maintain Usage Records:** They can keep track of the amount of time used by each user for each system unit - the CPU, secondary storage, and input and output devices. Such information is usually maintained for the purpose of charging users' departments for their use of the organisation's computing resources.
- (c) A decision support system has four basic components as discussed below:
- (i) **The users:** The user of a decision support system is usually a manager with an unstructured or semi-structured problem to solve. The manager may be at any level of authority in the organisation (e.g., either top management or operating management).
 - (ii) **Databases:** Decision support systems include one or more databases. These databases 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 organisation – for example, data about economic conditions, market demand for the organisation's goods or services, and industry competition.
 - (iii) **Planning languages:** Two types of planning languages that are commonly used in decision support systems are: (1) general –purpose planning languages and (2) special-purpose planning languages. General-purpose planning languages allow users to perform many routine tasks – for example, retrieving various data from a database or performing statistical analyses. These languages enable user to tackle a broad range of budgeting, forecasting, and other worksheet-oriented problems. Special-purpose planning languages are more limited in what they can do, but they usually do certain jobs better than the general-purpose planning languages. Some statistical languages, such as SAS, SPSS, and Minitab are examples of special purpose planning languages.
 - (iv) **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. There are many types of model bases, but most of them are custom-developed models that do some types of mathematical functions-for example, cross tabulation, regression analysis, time series analysis, linear programming and financial computations.
8. (a) A database management system software (DBMS) is the tool that computers use to achieve the processing and orderly storage of data. A database is a repository for related data. A database might contain information about customers, vendors, employees, sales and inventory. Each piece of information can be added to a database and extracted later in a meaningful way. DBMS is the collection of programs that allows users to access and work with a database.

Earlier information systems had a file processing orientation. Therefore, data needed for each user application was stored in independent data files. Processing consisted of using separate computer programs that updated these independent data files and used them to produce the documents and reports required by each separate user application. This file processing approach has several problems such as data duplication, lack of data integration and dependence of programs on data structure etc., that limit its efficiency and effectiveness for end- users.

1. **Data Duplication:** Independent data files include a lot of duplicated data; the same data such as customer's name and address is recorded and stored in several files. This data redundancy causes problems when data has to be updated, since separate file maintenance programs have to be developed and coordinated to ensure that each file is properly updated.
 2. **Lack of Data Integration:** Having data in independent files makes it difficult to provide end users with information for ad hoc requests that require accessing data stored in several different files. Special computer programs have to be written to retrieve data from each independent file. This is difficult, time consuming and expensive for the organization.
 3. **Data Dependence:** In file processing system, major components of a system i.e. the organization of files, their physical location on storage, hardware and the application software used to access those files depend on one another in a significant way. Application programs typically contain references to the specific format of data stored in the various files they use. Thus, if changes are made in the format and structure of data and records in a file, changes have to be made in all programs that use this file. This program maintenance effort is a major burden of file processing system.
 4. **Other Problems:** Data elements such as stock numbers and customer address are generally defined differently by different end users and applications. This causes serious inconsistency in the development of programs, which access such data. In addition, integrity of the data is suspected because there is no control over their use and maintenance by authorised end users.
- (b) The database administrator is a database professional who actually creates and maintains the database, and carries out the policies developed by the data administrator. The various functions performed by DBA are:
1. DBA is a data base professional who actually creates and maintains the data base, and also carries out the policies developed by the data administrator. The role of the DBA is more technical than that of the DA.
 2. DBA is responsible for defining the internal layout of the data base and also for ensuring that the internal layout optimises system performance, especially in main business processing areas.
 3. Defining the contents of the data base is an important part of data base creation and maintenance. The process of describing formats, relationships among various data elements and their usage is called data definition and the DBA uses data definition language (DDL) for this purpose.
 4. Maintaining standards and controlling access to data base are two other important functions that are handled by the DBA using DDL. The DBA specifies various rules which must be adhered to while describing data for a database.
 5. The DBA uses access controls to allow only specified users to access certain paths into the data base and thus prevent unauthorised access.
 6. The DBA also prepares documentation which includes recording the procedures, standards guidelines and data descriptions necessary for the efficient and continued use of the data base environment.

7. It is also a duty of the DBA to ensure that the operating staff performs its database processing related responsibilities which include loading the database, following maintenance and security procedures, taking backups, scheduling the database for use and following restart and recovery procedures after some hardware or software failure, in a proper way.
 8. The DBA also monitors the data base environments. He ensures that the standards for database performance are being met and the accuracy, integrity and security of data is being maintained.
 9. The DBA is also responsible for incorporating any enhancements into the database environment which may include new utility programs or new systems releases, and changes into internal procedures for using data base etc.
9. (a) The different types of databases are:
- (i) Operational Databases: These data bases store detailed data needed to support the operations of the entire organization. These are also called subject area data bases, transaction data bases and production data bases.
 - (ii) Management Databases: These data bases store data and information extracted from selected operational and external data base. They consist of summarized information mostly needed by the top management and other end users as part of their decision support systems and executive information systems to support managerial decision-making.
 - (iii) Information Warehouse Databases: It stores data from current and previous years. It contains data that has been extracted from the various operational and management databases of an organization. It is a central source of data that has been standardized and integrated so that it can be used by different levels of management in an organization.
 - (iv) Distributed Databases: These are data bases of local work groups and departments at regional offices, branch offices, manufacturing plants and other work sites.
 - (v) End user Databases: These data bases consist of data files developed by end users at their workstations. For example, users may have their own electronic copies of documents they have generated with word processing package or received by electronic mail.
 - (vi) External Databases: Access to external, privately owned online data bases or data banks is available for a fee, to the end users and organizations from commercial information services.
 - (vii) Text Databases: Text data bases are natural outgrowth of the use of computers to create and store documents electronically. Thus, online data base services store bibliographic information such as publications in larger text data bases. They are also available on CD-ROM or optical disks.
 - (viii) Image Database: A wide variety of images can also be stored electronically in image data bases. For example, electronic encyclopedia is available on CD-ROM. It can be used in document image processing. Thousands of pages of business documents can be optically scanned and stored as document images on a single optical disk. Workers can view and modify documents at their own workstations and electronically transfer them to the workstations of other end users in the organization.
- (b) Various phases to process the data in data warehousing are:
- (i) Offline Operational Databases – Data warehouses in this initial stage are developed by simply copying the database of an operational system to an off-line server where the processing load of reporting does not impact on the operational system's performance.

- (ii) **Offline Data Warehouse** – Data warehouses in this stage of evolution are updated on a regular time cycle (usually daily, weekly or monthly) from the operational systems and the data is stored in an integrated reporting-oriented data structure.
- (iii) **Real Time Data Warehouse** – Data warehouses at this stage are updated on a transaction or event basis, every time an operational system performs a transaction (e.g. an order or a delivery or a booking etc.).
- (iv) **Integrated Data Warehouse** – Data warehouses at this stage are used to generate activity or transactions that are passed back into the operational systems for use in the daily activity of the organization.

Various phases to process the data in data mining are:

- (i) **Selection** – Selecting or segmenting the data according to some criteria e.g. all those people who own a car, in this way subsets of the data can be determined.
 - (ii) **Preprocessing** – This is the data cleansing stage where certain information is removed which is deemed unnecessary and may slow down. Also the data is reconfigured to ensure a consistent format as there is a possibility of inconsistent formats because the data is drawn from several sources.
 - (iii) **Transformation** – The data is not merely transferred across but transformed in that overlays may be added such as the demographic overlays commonly used in market research. The data is made useable and navigable.
 - (iv) **Data mining** – This stage is concerned with the extraction of patterns from the data. A pattern can be defined as given a set of facts (data) F , a language L , and some measure of certainty C . A pattern is a statement S in L that describes relationships among a subset F_s of F with a certainty c such that S is simpler in some sense than the enumeration of all the facts in F_s .
 - (v) **Interpretation and evaluation** – The patterns identified by the system are interpreted into knowledge which can then be used to support human decision-making e.g. prediction and classification tasks, summarizing the contents of a database or explaining observed phenomena.
10. (a) The transmission of data from one computer to another, or from one device to another is known as data communication. A communications device, therefore, is any machine that assists data transmission. For example, modems, cables, and ports are all communications devices. A computer network is a collection of computers and terminal devices connected together by a communication system. The set of computers may include large-scale computers, medium scale computers, mini computers and microprocessors. All of the interconnected data communication devices can form a wide area network, a local area network, or a metropolitan area network, or virtual private network.
- (i) **Wide Area Networks (WAN)** – A WAN covers a large geographic area with various communication facilities such as long distance telephone service, satellite transmission, and under-sea cables. The WAN typically involves best computers and many different types of communication hardware and software. Examples of WANs are interstate banking networks and airline reservation systems. Wide area networks typically operate at lower link speeds (about 1 Mbps).
 - (ii) **Local Area Networks (LAN)** – By contrast, a LAN covers a limited area. A typical LAN connects as many as hundred or so microcomputers that are located in a relatively small area, such as a building or several adjacent buildings.
 - (iii) **Metropolitan Area Networks (MAN)** – A metropolitan area network (MAN) is somewhere between a LAN and a WAN. The terms MAN is sometimes used to refer to networks which connect systems or local area networks within a metropolitan area (roughly 40 kms in length from one point to another). MANs are based on fiber optic transmission technology and provide high speed (10 Mbps or so), interconnection

between sites. A MAN can support both data and voice, cable television networks are examples of MANs that distribute television signals. A MAN just has one or two cables and does not contain switching elements.

- (iv) Virtual Private Network (VPN) – 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 employee.

For more details of the above points, students are advised to refer to the study material Chapter-3.1 and 3.3.

- (b) Transmission protocols are sets of rules or conventions that must be adhered to by both the communicating parties to ensure that the information being exchanged between them is received and interpreted correctly. 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 being used.
 - (ii) Semantics – Type and order of messages used to ensure reliable and error-free information transfer.
 - (iii) Timing – Define data rate selection and correct timing for various events during data transfer.

Communication protocols are defined in layers, the first of which is the physical layer or the manner in which nodes in a network are connected to one another. Both the network software and network-interface card have to adhere to a network protocol. The RS-232 C connector is the standard for some communication protocols. Subsequent layers, the number of which vary between protocols, describe how messages are packaged for transmission, how messages are routed through network, security procedures and the manner in which messages are displayed.

A number of different protocol codes are in use. For example, X.12 is the standard for electronic data interchange (EDI) X.75 is used for interconnection between networks of different countries, and XMODEM is used for uploading and downloading files. The set of most common protocols used on the Internet is called TCP/IP.

There are three basic types of data transmission techniques as discussed below:

- (i) Circuit switching: Circuit switching is what most of us encounter on our home phones. We place a call and either get our destination party or, in case we encounter a busy signal, we cannot transmit any message. A single circuit is used for the duration of the call.
- (ii) Message switching: Some organizations, with a heavy volume of data to transmit, use a special computer for the purpose of data message switching. The computer receives all transmitted data; stores it; and when an outgoing communication line is available, forwards it to the receiving point.
- (iii) Packet switching: It is a sophisticated means of maximizing transmission capacity of networks. This is accomplished by breaking a message into transmission units, called packets and routing them individually through the network depending on the availability of a channel for each packet. Passwords and all types of data can be included within the packet and the transmission cost is by packet and not by message, routes or distance. Sophisticated error and flow control procedures are applied on each link by the network.

11. (a) Components of client server architecture are :

- (i) **Client:** Clients, which are typically PCs, are the “users” of the services offered by the servers described below. There are basically three types of clients. Non-Graphical User Interface (GUI) clients require a minimum amount of human interaction; non-GUIs include ATMs, cell phones, fax machines, and robots. Second, GUI-Clients are human interaction models usually involving object/action models like the pull-down menus in Windows 3-X. Object-Oriented User Interface (OOUI) Clients take GUI-Clients even further with expanded visual formats, multiple workplaces, and object interaction rather than application interaction. Windows 95 is a common OOUI Client.
 - (ii) **Server:** Servers await requests from the client and regulate access to shared resources. File servers make it possible to share files across a network by maintaining a shared library of documents, data, and images. Database servers own their processing power to executed Structured Query Language (SQL) requests from clients. Transaction servers execute a series of SQL commands, an online transaction-processing program (OLTP), as opposed to database servers, which respond to a single client command. Web servers allow clients and servers to communicate with a universal language called HTTP.
 - (iii) **Middleware:** The network system implemented within the client/server technology is commonly called by the computer industry as middleware. Middleware is all the distributed software needed to allow clients and servers to interact. General middleware allows for communication, directory services, queuing, distributed file sharing, and printing. Service-specific software like ODBC. The middleware is typically composed of four layers, which are Service, Back-end Processing, Network Operating System, and Transport Stacks.
 - (iv) **Fat-client or Fat-server:** Fat-clients or Fat-servers are popular terms in computer literature. These terms serve as vivid descriptions of the type of client/server systems in place. In a fat-client system, more of the processing takes place on the client, like with a file server or database server. Fat-servers place more emphasis on the server and try to minimize the processing done by clients.
 - (v) **Network:** The network hardware is the cabling, the communication cords, and the device that link the server and the clients. The communication and data flow over the network is managed and maintained by network software. Network technology is not well understood by business people and end users, since it involves wiring in the wall and function boxes that are usually in a closet.
- (b) A data center is a centralized repository for the storage, management and dissemination of data and information. Data centers can be defined as highly secure, fault-resistant facilities, hosting customer equipment that connects to telecommunications networks. Often referred to as an Internet hotel/ server farm, data farm, data warehouse, corporate data center, Internet service provide (ISP) or wireless application service provider (WASP), the purpose of a data center is to provide space and bandwidth connectivity for servers in a reliable, secure and scaleable environment. These data centers are also referred to as public data centers because they are open to customers.

A data center also provides certain facilities, like housing websites, providing data serving and other services for companies. The primary ‘goal’ of a data center is to deploy the requisite state-of-the-art redundant infrastructure and systems so as to maximize availability and prevent or mitigate any potential downtime for customers.

Challenges faced by the management are:

- (1) **Maintaining a skilled staff and the high infrastructure needed for daily data centre operations:** A company needs to have staff which is expert at network management and has Software / OS skills and hardware skills. The company has to employ a large

number of such people, as they have to work on rotational shifts. The company would also use additional cover in case a person leaves.

- (2) Maximising uptime and performance: While establishing sufficient redundancy and maintaining watertight security, data centres have to maintain maximum uptime and system performance.
 - (3) Technology selection: The other challenges that enterprise data centres face is technology selection, which is crucial to the operations of the facility, keeping business objectives in mind. Another problem is compensating for obsolescence.
 - (4) Resource balancing: The enterprise chief technical officer today needs to strike a working balance between reduced operational budgets, increased demands on existing infrastructure, maximizing availability, ensuring round-the-clock monitoring and management, and the periodic upgrades that today's technology demands.
- (c) The threats to the security of systems assets can be broadly divided into nine categories:
- (i) Fire,
 - (ii) Water,
 - (iii) Energy variations like voltage fluctuations, circuit breakage, etc.,
 - (iv) Structural damages,
 - (v) Pollution,
 - (vi) Intrusion like physical intrusion and eavesdropping which can be eliminated / minimized by physical access controls, prevention of electromagnetic emission and providing the facilities with their proper locations / sites,
 - (vii) Viruses and Worms,
 - (viii) Misuse of software, data and services which can be avoided by preparing an employees' code of conduct and
 - (ix) Hackers, the expected loss from whose activities can be mitigated only by robust logical access controls.

A virus is itself a program that instructs the operating system to append it to other programs and thus propagates to other programs via files containing macros which are sent as attachments to electronic mail messages. A virus can be benign like it can cause minor disruptions by printing laughing message or can be malignant like it can delete files or corrupt other programs.

12. (a) EC presents many benefits to individual organizations, consumers, and society as a whole. They are:
1. Reduced costs to buyers from increased competition in procurement as more suppliers are able to compete in an electronically open marketplace.
 2. Reduced errors, time, and overhead costs in information processing by eliminating requirements for re-entering data.
 3. 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.
 4. Reduced time to complete business transactions, particularly from delivery to payment.
 5. Creation of new markets through the ability to easily and cheaply reach potential customers.
 6. Easier entry into new markets, especially geographically remote markets, for companies of all sizes and locations.
 7. 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.

8. Faster time to market as business processes are linked, enabling seamless processing and eliminating time delays.
 9. 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.
 10. Reduced inventories and reduction of risk of obsolete inventories as the demand for goods and services is electronically linked through just-in-time inventory and integrated manufacturing
- (b) Supply chain management (SCM) is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption.

According to the Council of Supply Chain Management Professionals (CSCMP), a professional association that developed a definition in 2004, Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies. The following strategic and competitive areas can be used to their full advantage if a supply chain management system is properly implemented.

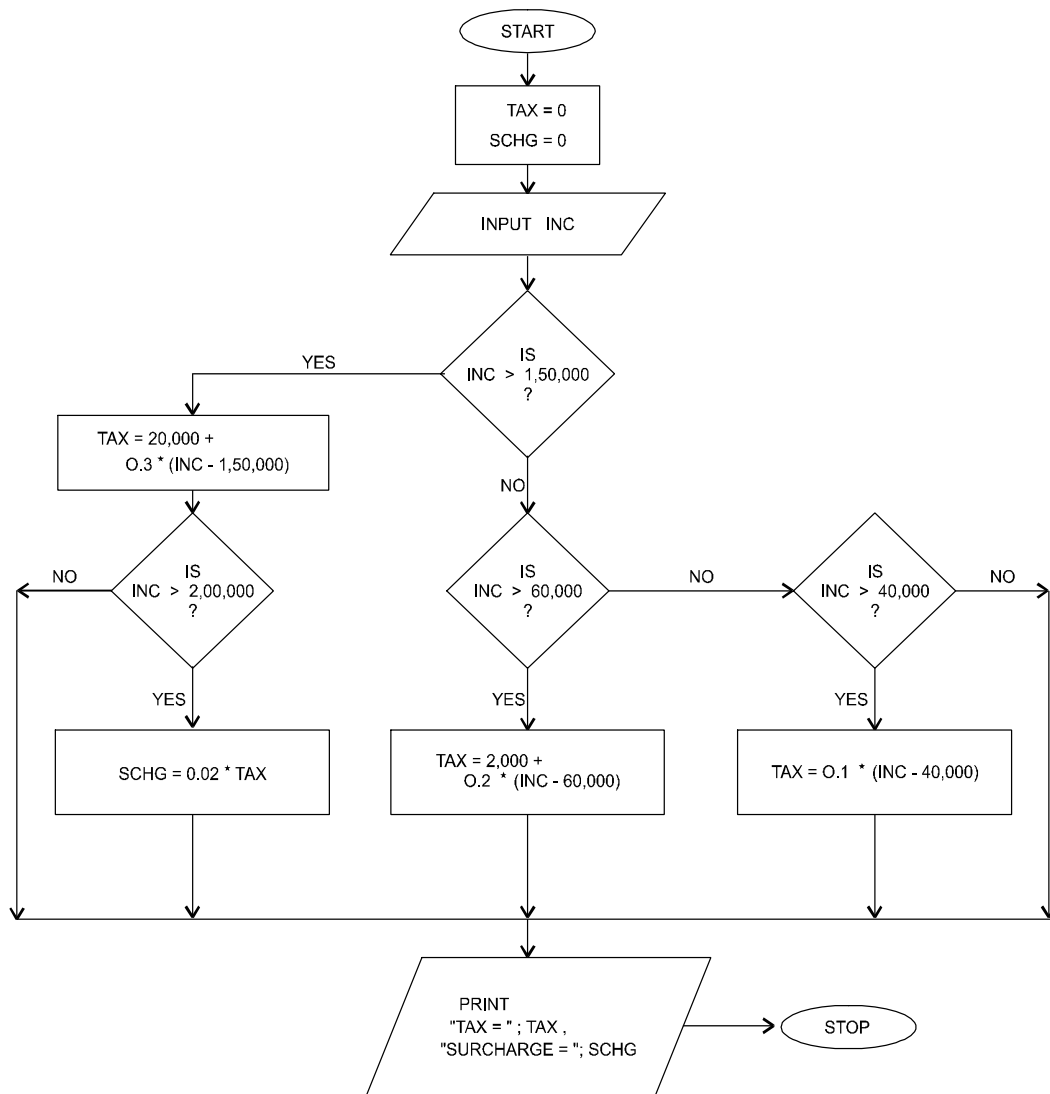
- (i) **Fulfillment:** Ensuring the right quantity of parts for production or products for sale arrive at the right time and is enabled through efficient communication, ensuring that orders are placed with the appropriate amount of time available to be filled. The supply chain management system also allows a company to constantly see what is on stock and making sure that the right quantities are ordered to replace stock.
- (ii) **Logistics:** Keeping the cost of transporting materials as low as possible consistent with safe and reliable delivery. Here the supply chain management system enables a company to have constant contact with its distribution team, which could consist of trucks, trains, or any other mode of transportation. The system can allow the company to track where the required materials are at all times. It may be cost effective to share transportation costs with a partner company if shipments are not large enough to fill a whole truck and this again, allows the company to make this decision.
- (iii) **Production:** Ensuring production lines function smoothly because high-quality parts are available when needed. 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.
- (iv) **Revenue & profit:** Ensuring no sales are lost because shelves are empty. 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.
- (v) **Costs:** Keeping the cost of purchased parts and products at acceptable levels. Supply chain management reduces costs by "increasing inventory turnover on the shop floor and in the warehouse", controlling the quality of goods thus reducing internal and external failure costs and working with suppliers to produce the most cost efficient means of manufacturing a product.

- (vi) Cooperation: Among supply chain partners, SCM ensures 'mutual success'. 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. This relationship allows a company to have access to current, reliable information, obtain lower inventory levels, cut lead times, enhance product quality, improve forecasting accuracy and ultimately improve customer service and overall profits. The suppliers also benefit from the cooperative relationship through increased buyer input from suggestions on improving the quality and costs and through shared savings. Consumers can benefit as well through higher quality goods provided at a lower cost.
- (c) The various advantages of EDI are:
- (i) Issue and receive orders faster – Since most purchasing transactions are routine, they can be handled automatically, utilising the staff for more demanding and less routine tasks.
 - (ii) Make sales more easily – Quotes, estimates, order entry and invoicing will proceed more smoothly and efficiently. Orders received electronically ensure that information is available immediately, so that an organisation can respond faster and be more competitive.
 - (iii) Get paid sooner – Invoices received electronically can be reconciled automatically, which means they are earmarked for payment in one's trading partner's accounting department sooner. And, in turn, your own purchasing department is in a position to negotiate for better terms including faster payment.
 - (iv) Minimise capital tied up in inventory – For manufacturing organisations with a just-in-time strategy, the right balance is crucial but every organisation stands to benefit from reducing order lead times.
 - (v) Reduce letters and memos – Letters and memos do not follow rigid rules for formatting. They can be handled by an electronic mail system.
 - (vi) Decrease enquiries – Customers or suppliers can make direct on-line enquiries on product availability, or other non-sensitive information instead of consuming the staff's precious time.
 - (vii) Make bulk updates of catalogues and parts listings – One can provide updates of data files, such as catalogues to customers or part listings to franchisees.

13. The required flowchart is given on next page:

14. Decision Table

	Rules			
	1.	2.	3.	4.
Conditions	Condition entries			
Sales region code = 10.	Y	Y	N	N
Invoice amount < Rs. 10,000	Y	N	Y	N
Action Stub	Action entry			
Delivery charges				
Add Rs. 100 to invoice total	X			
Add Rs. 150 to invoice total	X			
Add Rs. 200 to invoice total	X			
Add Rs. 250 to invoice total	X			



15. (i) **Tape Cartridge Systems:** Cartridge tapes represent the leading edge of tape technology. Tape cartridge are available for both large and small computer systems. Tape cartridge for microcomputer systems, which resemble cassette tapes in appearance, are frequently used to back up hard disks. These tapes, which are not designed for processing purposes, are sometimes called streaming tapes. The capacities of these tapes vary, but several megabytes of storage are typical. Streaming tapes can usually back up the contents of a hard disk in a few minutes. In 1986, IBM introduced a tape cartridge system, the IBM 3480 for its 3090 line of mainframes. Each of these cartridges has a capacity of 200 MB and a data-transfer rate of 3 MB/Sec. Unlike conventional detachable-reel tapes, which uses 9 parallel tracks, these ½ inch tapes store data in 18 tracks. In 1992, IBM released 36 track tape cartridges for use in its mainframes and AS/400 family of midrange computers.
- (ii) **Bar Code Reader:** The most widely used input device after the keyboard and mouse is the flatbed or hand-held bar code reader commonly found in supermarkets and departmental stores. These devices convert the bar code, which is a pattern of printed bars on products, into a product number by emitting a beam of light – frequently a laser beam – which reflects off the bar code image. A light-sensitive detector identifies the bar code image by recognizing special bars at both ends of the image. Once the detector has identified the bar code, it converts the individual bar patterns into numeric digits. The special bars at each end of the image are different, so the reader can tell whether the bar code has been read right side up or upside down. After the bar code reader has converted a bar code image into a

number, it feeds that number to the computer, just as though the number had been typed on a keyboard.

Bar codes provide the advantages of improved accuracy of data entry, better customer service through faster checkout at the point of sale, and greater control and reliability of inventory records. They are used in industries and organizations that must count and track inventory, such as retail, medical, libraries, military and other government operations, transportation facilities, and the automobile industry.

- (iii) **Debugging:** In computers, debugging is the process of locating and fixing or bypassing bugs (errors) in computer program code or the engineering of a hardware device. To debug a program or hardware device, start with a problem, isolate the source of the problem, and then fix it. A user of a program that does not know how to fix the problem may first learn enough about the problem to be able to avoid it until it is permanently fixed. Debugging is a necessary process in almost any new software or hardware development process, whether a commercial product or an enterprise or personal application program. For complex products, debugging is done as the result of the unit test for the smallest unit of a system, again at component test when parts are brought together, again at system test when the product is used with other existing products, and then during customer beta test, when users try the product out in a real world situation.
- (iv) **SQL:** A query language is a set of commands to create, update and access data from a database allowing users to raise adhoc queries / questions interactively without the help of programmers. A structured query language (SQL) is a set of thirty (30) English like commands which has since become an adoptable standard. The structured query language syntax use some set of commands regardless of the database management system software like 'Select', 'From', 'Where'.

Some query languages have been designed in such a way that the command used is as close to Standard English text as possible. Query languages in a user-friendly way allow users to retrieve data from database without exposure to -

- (i) file / record structure,
- (ii) processes that the system performs,
- (iii) Languages like Common Business Oriented Language (COBOL), Beginner's All-purpose Symbolic Instruction Code (BASIC) or such other standard programming languages. Data retrieving efficiency may be improved by gaining knowledge about query shortcuts, query strategies and the types of data used in the database. A training and development program for this purpose may prove useful for the end users.
- (v) **ISDN:** Integrated Services Digital Network (ISDN) is a system of digital phone connections to allow simultaneous voice and data transmission across the world. Such voice and data are carried by bearer channels (B channels) having a bandwidth of 64 kilobits per second. A data channel can carry signals at 16 kbps or 64 kbps, depending on the nature of service provided. There are two types of ISDN service – Basic Rate Interface (BRI) and Primary Rate Interface (PRI). BRI consists of two 64 kbps B channels and one 16 kbps D channel for a total of 144kbps and is suitable for individual users. PRI consists of twenty three B channels and one 64 kbps D channel for a total of 1536 kbps and is suitable for users with higher capacity requirements. ISDN allows multiple digital channels to be operated simultaneously through the same regular phone cable meant for analog signals. It is possible to combine many different digital data sources and have the information routed to the proper destination.
- (vi) **World Wide Web:** The World Wide Web or the Web is a component of the Internet that provides access to large amount of information located on many different servers. The Web also provides access to many of the services available on the Internet. The fundamental unit of the Web is the Web page. The Web page is a text document that contains links to other Web pages, graphic and audio files, and other Internet services such as file transfer protocol

(FTP) and E-mail. Web pages reside on servers that run special software that allow users to access Web pages and to activate links to other Web pages and to Internet services. Tens of thousands of Web servers are currently connected to the Internet. A user can directly access any Web page on one of these servers and then follow the links to other pages. This process creates a Web of links around the world and, thus, the name World Wide Web. To view a Web page, the user must use a special client software package called a Web browser. The first such browser capable of displaying graphics within a Web page was Mosaic. Since Mosaic's development, Netscape and Internet Explorer have also been created and are widely used.

- (vii) E-mail: Internal or "group" email enables staff in the office to communicate with each other quickly and effectively. Group email applications also provide capabilities for contact management, scheduling and task assignment. Designated contact lists can be shared by the whole organization instead of duplicated on each person's own rolodex; group events can be scheduled on shared calendars accessible by the entire staff or appropriate groups. Equally important is a network's ability to provide a simple organization-wide conduit for Internet email, so that the staff can send and receive email with recipients outside of the organization as easily as they do with fellow staff members. Where appropriate, attaching documents to Internet email is dramatically faster, cheaper and easier than faxing them.
- (viii) 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.

Using a credit card to make a purchase over the Internet follows the same scenario. However, on the Internet added steps must be taken to provide for secure transactions and authentication of both buyer and seller. This has led to a variety of systems for using credit cards over the Internet. Two of the features distinguishing these systems are the level of security they provide for transactions, and the software required 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.
- (ix) Wi-Fi Technology: Wifi (also WiFi, Wi-fi or wifi) is a brand originally licensed by the Wi-Fi Alliance to describe the underlying technology of wireless local area networks (WLAN) based on the IEEE 802.11 specifications. Wi-Fi stands for Wireless Fidelity. Wi-Fi was intended to be used for mobile computing devices, such as laptops, in LANs, but is now often used for increasingly more applications, including Internet and VoIP phone access, gaming, and basic connectivity of consumer electronics such as televisions and DVD players. There are even more standards in development that will allow Wi-Fi to be used by cars in highways in support of an Intelligent Transportation System to increase safety, gather statistics, and enable mobile commerce .

A person with a Wi-Fi device, such as a computer, telephone, or personal digital assistant (PDA) can connect to the Internet when in proximity of an access point. The region covered by one or several access points is called a hotspot. Hotspots can range from a single room to many square miles of overlapping hotspots. Wi-Fi can also be used to create a Wireless mesh network. Both architectures are used in Wireless community network, municipal wireless networks, and metro-scale networks. Wi-Fi also allows connectivity in peer-to-peer mode, which enables devices to connect directly with each other. This connectivity mode is useful in consumer electronics and gaming applications.