

PAPER – 6A : INFORMATION TECHNOLOGY

QUESTIONS

1. Define the following terms briefly:
 - (a) Multiprocessing
 - (b) Fat Server
 - (c) Subroutine
 - (d) Mesh Topology
 - (e) Multiplexer
 - (f) Modem
 - (g) Transaction Log
 - (h) Data Definition Language
 - (i) Memo Data Type
 - (j) Intrusion Detection System
 - (k) File Sharing
 - (l) Remote Access
 - (m) Access Time
 - (n) Screen Resolution
 - (o) VPN
 - (p) Artificial Intelligence
 - (q) Encryption
 - (r) Proxy Server
 - (s) Light Pen
 - (t) Hollerith Code
2. Differentiate between the following:
 - (a) CD-R and CD-RW
 - (b) Contact Cards and Contactless Cards
 - (c) Star Topology & Ring Topology
 - (d) Operational CRM and Collaborative CRM
 - (e) B2B and B2C
 - (f) Network Intrusion Detection and Host-based Intrusion Detection
 - (g) Solid Inkjet and Liquid Inkjet printers
 - (h) Compilers and Interpreters
 - (i) Fixed-point Representation and Floating-point Representation
 - (j) Primary Key and Alternate Key
 - (k) Track Ball and Joystick
 - (l) Second Generation and Third Generation Computers
3. Convert the following from one number system to another number system along with working notes:
 - (a) $(1324)_{10} = ()_2$
 - (b) $(1101001)_2 = ()_{10}$
 - (c) $(225.25)_{10} = ()_2$

- (d) $(100101.101)_2 = ()_{10}$
4. (a) Computers are helpful but they have certain limitations also. Please explain this statement briefly.
(b) What do you mean by a port? Describe the various types of ports.
 5. (a) What is a magnetic tape? Discuss different types of magnetic tapes.
(b) Describe the various characteristics of printers in brief.
 6. (a) Describe the various steps of document imaging. Also mention the advantages of image processing.
(b) What are the various types of storage? Also name the various characteristics of storage on which storage devices can be classified.
 7. (a) What do you mean by General-purpose software? Give four examples with their usage.
(b) "ERP can perform certain tasks of an organization in well-structured manner." Describe in brief.
 8. (a) What is file organization? Describe different types of file organizations in brief.
(b) Which factors determine the best file organization for a particular application? Which file organization is best suited for storing payroll records of all employees in the finance department? Explain briefly.
 9. (a) Define different types of database structures in brief.
(b) What do you understand by Client-Server database and Knowledge database? Explain in brief.
 10. (a) Write the limitations of traditional computing models. Why the need for client-server model arose? Discuss briefly.
(b) How has ISO facilitated the communication of heterogeneous hardware or software platforms? Explain in brief.
(c) What do you understand by 3-Tier and n-Tier Architecture? Discuss in brief.
 11. (a) What is VPN? Discuss different types of VPN.
(b) Explain different types of data communication modes briefly.
(c) What is ISDN? Write its advantages in brief.
 12. (a) How are documents transmitted between one computer and another computer?
(b) Describe different types of electronic payment systems in brief.
(c) What do you mean by Bluetooth technology? Discuss its uses and features.
 13. (a) Why Internet has emerged as the foundation for the world's new information infrastructure?
(b) What is CRM? What does a good CRM program need to do in order to be effective?

- (c) What do you mean by SCM? Which problems need to be addressed by SCM?
14. (a) Mention the six phases of computer programming process.
- (b) What do you understand by program analysis and algorithm? Explain with an example.
- (c) What is the relevance of flowchart in system programming? Describe the various categories of flowcharts.
15. Draw a flow chart to illustrate the following situation. Ganesh Limited calculates discounts allowed to customers on the following basis:

Order Quantity	Normal Discount
1-99	5%
100-199	7%
200-499	9%
500 and above	10%

These discount apply only if the customer's account balance is below Rs. 500 and does not include any item older than three months. If the account is outside both these limits, the above discounts are reduced by 2%. If only one condition is violated, the discounts are reduced by 1%. If a customer has been trading with Ganesh Limited for over 5 years and conforms to both of the above credit checks, then he is allowed an additional 1% discount.

16. A school is admitting students in class I if they satisfy any one of the following conditions:
- (a) Student has done KG from a recognized school and he/she resides in Delhi.
- (b) Student has done KG from an unrecognized school and he/she has cleared the admission test.
- (c) Student has done KG from an unrecognized school, has not cleared the admission test, but the parents are well educated.

Prepare a decision table for the above procedure.

17. Write short notes on the following:
- (a) Workstations
- (b) Cards
- (c) BCP
- (d) MICR
- (e) Enterprise Marketing Automation
- (f) Communication Services
- (g) Data Warehouse
- (h) Webcasting

- (i) Graph Plotter
- (j) The Bullwhip Effect
- (k) Data Mining

SUGGESTED ANSWERS/HINTS

1. (a) **Multiprocessing:** Multiprocessing (or parallel processing) refers to the use of two or more central processing units, linked together, to perform coordinated work simultaneously. Instructions are executed simultaneously by different CPUs at any given time.
- (b) **Fat Server:** In a fat-server system, more of the processing takes place on the server. Fat-servers try to minimize the processing done by clients. Examples of fat-servers are transaction, GroupWare, and web servers. They are also referred to as "3-Tier" systems.
- (c) **Subroutine:** A subroutine is a subset of instructions that are called or executed from a main program or finds applications in several programs. It is economical to write it once. Subroutines may be incorporated in the main program from a library of subroutines.
- (d) **Mesh Topology:** A random connection of nodes using communication links is known as mesh topology. 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.
- (e) **Multiplexer:** Multiplexer enables several devices to share one communication line. It scans each device to collect and transmit data on a single line to the CPU, and also communicates transmission from the CPU to the appropriate terminal linked to the multiplexer. The devices are polled and periodically asked whether there is any data to transmit.
- (f) **Modem:** Modem stands for Modulator/Demodulator. It is a device that converts a digital computer signal into an analog telephone signal (i.e. it modulates the signal) and converts an analog telephone signal into a digital computer signal (i.e. it demodulates the signal) in a data communication system.
- (g) **Transaction log:** A transaction log is a file that records database modifications such as inserts, updates, deletes, commits, rollbacks, and database schema changes. The database engine uses a transaction log to apply any changes made between the most recent checkpoint or a system failure.
- (h) **Data Definition Language:** Data Definition Language (DDL) defines the conceptual schema providing a link between the logical (the way the user views the data) and physical (the way in which the data is stored physically) structures of the database. It defines the physical characteristics of each record, field in the record, field's data

type, field's length, field's logical name and also specifies relationships among the records.

- (i) Memo data type: A data type that can store up to 65,536 characters. It can be used if there is a requirement to store more than 255 characters.
- (j) Intrusion Detection System: Intrusion detection systems (IDS) are used for detecting inappropriate, incorrect, or anomalous activity on the network from outside. ID systems can be host-based or network-based. They provide automated network-based security assessment and policy compliance evaluation.
- (k) File Sharing: File sharing consists of grouping files together on a server or servers. When files in an organization are concentrated in one place, documents can be shared easily by all users in a networked environment.
- (l) Remote Access: Remote access allows users to login and access in to his/her organization's network via internet and access all of the same network resources they can access when they're in the office.
- (m) Access Time: Access time is the time interval between the instant when a computer or control unit calls for a transfer of data to or from a storage device and the instant when the operation is completed. Thus, access time is the sum of the waiting time and transfer time.
- (n) Screen Resolution: It indicates the degree of detail – that can be perceived, which depends on the number of pixels used to display any image. The more pixels that are available to display any image on-screen, the sharper the image is. The higher the resolution, the finer the detail is.
- (o) VPN: A VPN (Virtual Private Network) is a private network that uses a public network (usually the Internet) to connect remote sites or users together. It uses “virtual” connections routed through the Internet from the company's private network.
- (p) Artificial Intelligence: Artificial intelligence (AI) is software that tries to emulate aspects of human behavior, such as reasoning, communicating, seeing, and hearing. AI includes natural language, voice and visual recognition, robotics, neural networks, and expert systems.
- (q) Encryption: It involves encoding and transmitting the encoded message so that any eavesdropper is not able to understand what is being sent. Encryption allows information to transit the Internet while being protected from interception by eavesdroppers.
- (r) Proxy Server: A server which is designed to restrict access to information on the Internet is called proxy server. It operates on a list of rules given to it by a System Administrator. It can be used to restrict or prohibit the flow of certain types of information to the network.

- (s) 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.
 - (t) Hollerith Code: Hollerith Code is used for representing alphanumeric data on punched cards. Each card column holds one character. Each decimal digit, letter, or special character is represented by one, two or three holes punched into designated row positions of a column.
2. (a) CD-R stands for compact disc, recordable. It can be written only once, though it can be read as many times as required. In a CD-R, an extra organic polymer dye layer lies between the polycarbonate and metal layers, which serve as a recording medium. A pregrooved spiral track guides the laser for recording data, which is encoded from the inside to the outside of a CD in a continuous spiral.

CD-RW stands for compact disc, rewritable. This allows for repeated recordings on a disc. It can be rewritten a number of times. It is relatively more expensive than the CD-R. It uses an alloy that can change to and fro from a crystalline form when exposed to a particular light. The technology of this process is called phase changing. The patterns, however, are less distinct than that of CD-R.

- (b) Contact cards, are smart cards that are required to be inserted into a reader in order to work, such as a smart card reader or automatic teller machines. They have a contact area, comprised of several gold-plated contact pads, that is about 1 cm square. When inserted into a reader, the chip makes contact with electrical connectors that can read information from the chip and write information back. The cards do not contain batteries; energy is supplied by the card reader.

Contactless cards, on the other hand, are smart cards that don't need to be inserted into a reader. Just waving them near a reader is sufficient for the card to exchange data. This type of card is used for opening doors. In contactless cards, the chip communicates with the card reader through RFID (Radio-Frequency Identification) induction technology.

- | (c) | S.NO. | Star topology | Ring topology |
|-----|-------|---|---|
| | 1 | Processing nodes interconnect directly with a central system. Each node can communicate only with the central site and not with other nodes in the network. | Processing nodes are connected in the form of a loop or ring. There is a direct unidirectional point-to-point link between two neighboring nodes. |
| | 2 | A node can transmit information to other node by sending the details to the central node, by sending the details to the central node, which in turn sends them to the | Since the links are unidirectional, transmission by a node traverses the whole ring and comes back to the node, which made the transmission |

destination.

- | | | |
|----|--|--|
| 3. | It is easy to add or remove computers. | Adding or removing computers can disrupt the entire network. |
| 4. | A node failure does not bring down the entire network, but if the central hub fails, the whole network ceases to function. | A node failure can affect the whole network |
| 5. | It is easier to diagnose network problems | It is difficult to troubleshoot a ring network through the central hub |

- (d) Operational CRM means supporting the front office business processes, which include customer contact like sales, marketing and service. Tasks resulting from these processes are forwarded to employees responsible for them. The information necessary for carrying out the tasks and interfaces to back-end applications are being provided to the employees, and activities with customers are being documented for further reference. It provides the following benefits –

1. Delivers personalized and efficient marketing, sales, and service through multi-channel collaboration.
2. Enables a reverse view of the customer while the organization is interacting with them.
3. Sales people and service engineers can access complete history of all customer interaction with your company, regardless of the touch points.

Collaborative CRM facilitates interaction and communication with customers through various channels like personal, letter, fax, phone, web, e-mail and supports co-ordination between employee teams and channels. It brings people, processes and data together so that companies can better serve and retain their customers. The data/activities can be structured, unstructured, conversational, and/or transactional in nature. It provides the following benefits –

1. Enables efficient productive customer interactions across all communications channels.
2. Enables web collaboration to reduce customer service costs.
3. Integrates call centers enabling multi-channel personal customer interaction.
4. Integrates view of the customer while interaction at the transaction level.

For more details of the above points, students are advised to refer to the study material Chapter - 4.8.

- (e) B2B stands for 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. It can also encompass marketing activities between businesses, and not just the final transactions that result from marketing. It is also used to identify sales transactions between businesses.

B2C stands for 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. It minimizes internal costs created by inefficient and ineffective supply chains and creates reduced end prices for the customers. Two Classifications of B2C E-Commerce are –

1. Direct Sellers: Companies that provide products or services directly to customers are called direct sellers. There are two types of direct sellers: E-tailers and Manufacturers.
 2. Online Intermediaries: Online intermediaries are companies that facilitate transactions between buyers and sellers and receive a percentage. There are two types of online intermediaries: brokers and infomediaries.
- (f) Network Intrusion Detection (NID) deals with information passing on the wire between hosts. NID devices intercept packets traveling along various communication mediums and protocols, usually TCP/IP. Once captured, the packets are analyzed in a number of different ways. Some NID devices will simply compare the packet to a signature database consisting of known attacks and malicious packet "fingerprints", while others will look for anomalous packet activity that might indicate malicious behavior. NID deals with data transmitted from host to host

Host-based Intrusion Detection (HID) systems are designed to monitor, detect, and respond to user and system activity and attacks on a given host. Some more robust tools also offer audit policy management and centralization, supply data forensics, statistical analysis and evidentiary support, and in certain instances provide some measure of access control. HID is concerned with what occurs on the hosts themselves.

- (g) Solid Inkjet printers use solid ink sticks that are melted into a reservoir and sprayed in precisely controlled drops onto the page where the ink immediately hardens. High- pressure rollers flatten and fuse the ink to the paper to prevent smearing. These printers are sometimes referred to as phase-change printers because the ink moves from a solid to a liquid phase to be printed then back to a solid phase on the page. As a final step, the paper moves between two rollers to cold-fuse the image and improves the surface texture.

Liquid inkjet printers use ink cartridges from which they spray ink onto the paper. A cartridge of ink attached to a print head with 50 or so nozzles, each thinner than a human hair, moves across the paper. The number of nozzles determines the printer's resolution. A digital signal from the computer tells each nozzle when to

propel a drop of ink onto the paper. On some printers, this is done with mechanical vibrations.

(h)	S.No.	Compilers	Interpreters
	1.	Compilers translate the entire program into machine language before the program is executed.	Interpreters translate programs a line at a time as they are being run. Each statement is translated into machine language just before it is executed.
	2.	Programs can be executed more swiftly since they are translated before execution.	Program execution is slow as translation is done while executing.
	3.	Machine language programs can be saved on disk for future use.	Machine language programs are produced while executing, hence they cannot be saved.
	4.	It is hard to debug programs since the error codes are received only after complete compilation and it is difficult to locate error from those messages.	Debugging programs is easier as interpreter stops on the line in which error is encountered. It can exactly show the statement which triggered the error.
	5.	Compile, link-edit and execution stages are there which are time-consuming.	Direct machine code is produced. Hence, they are usually easier and faster to use.
	6.	A compiler for a 3GL requires more storage space.	An interpreter for a 3GL does not require much storage space.

- (i) Fixed-point representation represents all numbers as integers or fractions. Signed integer or BCD numbers are referred to as fixed-point numbers because they contain no information regarding the location of the decimal point or the binary point. The binary or decimal point is assumed to be at the extreme right or left of the number.

Floating-point representation keeps track of the position of the binary or decimal point. For example, the numbers 0.008 and 1345.66 can be represented as 0.8×10^{-2} and 1.34566×10^3 respectively. This kind of representation is called the scientific representation. Using this scientific form, any number can be expressed as a combination of a mantissa and an exponent, or in other words, the number 'n' can

be expressed as $n = m \cdot r^e$ where 'm' is the mantissa, 'r' is the radix of the number system and 'e' is the exponent.

- (j) Primary key of any table is a candidate key of that table which the database designer designates as "primary" and it uniquely identifies each row in a table. A candidate key is any set of one or more columns whose combined values are unique among all occurrences. No two rows in a table can have the same value (or combination of values) in those columns. Since a null value is not guaranteed to be unique, no component of a candidate key is allowed to be null. A primary key must uniquely identify all possible rows that exist in a table and not only the currently existing rows. A table can have only one primary key.

Alternate keys of any table are simply those candidate keys which are not currently selected as the primary key. It is a unique identifier for an entity instance. An alternate key is a function of all candidate keys minus the primary key. A table may have many alternate keys. For example, a relational table consisting of details about all the employees in an organization has the following candidate keys: SSN (Social Security Number), Employee Code. Suppose SSN is selected as the primary key, then Employee Code becomes the alternate key. It can be vice-versa also.

- (k) 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. Track balls are particularly popular among users of notebook computers.

Joystick is a screen pointing input device. It is a vertical lever usually placed in a ball socket, which can be shifted in any direction to control cursor movements. It is useful for computer games and for some professional applications.

- | (l) | S.No. | Second Generation Computers | Third Generation Computers |
|-----|-------|--|--|
| | 1. | They were made of transistors and other solid state devices. | They were made of integrated circuits. |
| | 2. | Smaller than vacuum tubes and generate less heat | High capacity Integrated circuits and more reliable than second generation |
| | 3. | They used magnetic tape for secondary storage. | They used magnetic disk units for secondary storage. |
| | 4. | No concept of simultaneous execution of programs was there. | They permit multiprogramming and time-sharing. |
| | 5. | Core storage of a computer was fixed. | Core storage of a computer could be expanded by adding modules. |

For more details of the above points, students are advised to refer to the ITT study material Chapter-1.6.

3. (a) $(1324)_{10} = ()_2$

2	1324	
2	662	0
2	331	0
2	165	1
2	82	1
2	41	0
2	20	1
2	10	0
2	5	0
2	2	1
2	1	0
	0	1

$$(1324)_{10} = (10100101100)_2$$

(b) $(1101001)_2 = ()_{10}$

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

$$= 64 + 32 + 0 + 8 + 0 + 0 + 1$$

$$= 105$$

$$(1101001)_2 = (105)_{10}$$

(c) $(225.25)_{10} = ()_2$

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	225	
2	112	1
2	56	0
2	28	0
2	14	0
2	7	0
2	3	1
2	1	1
	0	1

$$(225)_{10} = (11100001)_2$$

Step – II

$$.25 \times 2 = .50$$

$$.50 \times 2 = 1.0$$

$$(.25)_{10} = (.01)_2$$

So,

$$(225.25)_{10} = (11100001.01)_2$$

$$\begin{aligned} \text{(d) } (100101.101)_2 &= ()_{10} \\ &= 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} \\ &= 32 + 0 + 0 + 4 + 0 + 1 + \frac{1}{2} + 0 + \frac{1}{8} \\ &= 37.625 \\ (100101.101)_2 &= (37.625)_{10} \end{aligned}$$

4. (a) Computers are helpful due to the following characteristics:

1. **Speed:** Computer operations are measured as their processing in milliseconds, microseconds, nanoseconds, and picoseconds (one thousandth, one millionth, one billionth, and one trillionth of a second, respectively).
2. **Accuracy:** Errors do occur in computer-based information systems, but precious few can be directly attributed to the computer system itself. The vast majority can be traced to a program logic error, a procedural error, or erroneous data. These are human errors.
3. **Reliability:** Computer systems are particularly adept at repetitive tasks. They produce the same results always if same input is given. Companies in which no downtime is acceptable, provide backup computers that take over automatically if the main computers fail.
4. **Memory Capability:** Computer systems have total and instant recall of data and an almost unlimited capacity to store these data. High-end PCs have access to about a billion characters of data.

But computers have certain limitations also, which are mentioned below.

1. **Program must be reliable:** The computer does what it's programmed to do and nothing else. A clever program can be written to direct the computer to store the results of previous decisions. Then, by using the program's branching ability, the computer may be able to modify its behavior according to the success or failure of past decisions. But a program that has operated flawlessly for months can suddenly produce nonsense. Also, a reliable program that's supplied with incorrect data may also produce nonsense.
2. **Application logic must be understood:** The computer can only process jobs which can be expressed in a finite number of steps leading to a specific goal. Each step must be clearly defined. If the steps in the solution cannot be precisely stated, the job cannot be done. This is why the computer may not be helpful to people in areas where subjective evaluations are important.

- (b) Ports and connectors are components of the motherboard that let the user connect external devices like printers, keyboards or scanners and let them interface with the PC. The physical interfaces for the ports and connectors are located on the outside—typically at the back of the PC, but they are directly or indirectly (using a connector card) connected to the motherboard. There are various types of ports or connectors, each providing different data transfer speeds to connect various external peripherals.
1. 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.
 2. Com/Serial ports: They are used for connecting communication devices like modems or other serial devices like mice. There are two varieties of Com ports—the 9-pin ports and 25-pin ports. Serial Ports facilitate the serial transmission of data, i.e. one bit at a time.
 3. IDE drive connector: IDE devices like CD-ROM drives or hard disk drives are connected to the motherboard through the IDE connector.
 4. Floppy drive connector: The floppy drive connectors are used for connecting the floppy drive to the motherboard, to facilitate data exchange.
 5. USB connectors: USB stands for Universal Serial Bus. These ports provide the user with higher data transfer speeds for different USB devices like keyboards, mice, scanners or digital cameras.
 6. PS/2 Connectors: PS/2 stands for Personal System/2. PS/2 connectors are used to connect PS/2 based input devices like PS/2 keyboards or mice.
5. (a) Magnetic tape is a storage device in which data can only be accessed sequentially. Many data processing operations are sequential or batch oriented in nature, and tape is still economical. The two most popular forms of magnetic tape used for large system MIS applications are detachable reel magnetic tapes and tape cartridges.
1. Detachable Reel Magnetic Tapes are used with mainframes and minicomputers. These tapes are stored on detachable reels. These plastic tapes are, like disks, coated with a magnetizable surface (often iron oxide) that can be encoded with 0 and 1 bits. A 2,400 feet reel of ½ inch diameter tape packs data at 6,250 bytes per inch. Recording densities of tapes are often cited as bytes per inch (bpi) because in most instances, a character (byte) is represented as a vertical slice of bits across the tracks of tape surfaces. Tapes are read on a hardware device called a tape unit. Basically, this unit works the same way as the reel-to-reel tape units that were once popular on home stereo systems. The tape is processed by passing it under read/write heads located between the two reels. Depending on the instructions given to the computer system, data can then either be read from the tape or written to it. It uses 9 parallel tracks to store data.

2. Tapes Cartridge Systems represent the leading edge of tape technology. Tape cartridges are available for both large and small computer systems. Tape cartridges 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. 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.

(b) Various characteristics of printers are:

- (i) Speed: The speed of a printer is measured in terms of cps (characters per second), lps (lines per second) or ppm (pages per minute). The speed of a dot-matrix printer is measured in cps. While the speed can vary widely, it is generally 200 cps. A line printer prints a line at a time. Its speed can be anywhere from 5 to 50 lps.

- (ii) Quality of output: Depending on the type of characters formed, printers can be classified as draft, near letter quality (NLQ) or letter quality printers.

In a draft quality printer, a character is formed by arranging dots to resemble it. Although the characters can be distinguished, the output is not as good as that of near letter quality printouts. A dot-matrix printer is an example of a draft printer.

Near letter quality (NLQ) printers use a special character which resembles that of a typewriter. A daisy wheel printer is an example of a NLQ printer. Most dot-matrix printers can also be set to produce near - letter quality printouts.

Letter quality printers use a character set in which each letter or character is fully formed. The quality of output is the best in such printers. A laser printer is an example of a letter quality printer.

- (iii) Direction: Printers can be unidirectional or bi-directional. In a unidirectional printer, printing takes place in one direction only. After printing a line from left to right, the print head returns to the left without printing. A bi-directional printer prints both ways.

6. (a) Image Processing captures an electronic image of data so that it can be stored and shared. There are five distinct steps to document imaging:

1. Step1: 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. The 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.

2. Step2: 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.
3. 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.
4. 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.
5. Step5: 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 are as follows:

- (i) Accessibility: Documents can be accessed and reviewed simultaneously by many people, even from remote locations.
 - (ii) Accuracy: Accuracy is much higher because costly and error-prone manual data-entry processes are eliminated.
 - (iii) Availability: There are no more lost or misfiled documents.
 - (iv) Capacity: Vast amounts of data can be stored in very little space, which significantly reduces storage and office space.
 - (v) Cost: When large volumes of data are stored and processed, the cost per document is quite inexpensive. As a result, the costs to input, file, retrieve, and refile documents are reduced significantly.
 - (vi) Customer satisfaction: When waiting time is significantly reduced (due to lost or misfiled documents, queue time, etc.), customers can get the information almost immediately.
 - (vii) Security: Various levels of passwords (network, data base, files, etc.) and clearances can be assigned to restrict document access.
 - (viii) Speed: Data can be retrieved at fantastic speeds. Stored documents can be indexed using any number of identifying labels, attributes, or keywords.
 - (ix) 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.
- (b) A computer system usually contains several kinds of storage, each with an individual purpose, as mentioned below:
- (i) Primary Storage: Primary storage is directly connected to the central processing unit of the computer. It must be present for the CPU to function correctly. Primary storage typically consists of three kinds of storage:

1. Processor registers are internal to the central processing unit. Registers contain information that the ALU needs, to carry out the current instruction.
 2. Main memory contains the programs that are currently being run and the data on which the programs are operating.
 3. Cache memory is a special type of internal memory used by central processing units to increase their performance or "throughput". Some of the information in the main memory is duplicated in the cache memory, which is slightly slower but of much greater capacity than the processor registers, and faster but much smaller than main memory.
- (ii) Secondary, tertiary and off-line storage
1. Secondary storage requires the computer to use its input/output channels to access the information, and is used for long-term storage of persistent information.
 2. Tertiary storage is used in the realms of enterprise storage and scientific computing on large computer systems and business computer networks, and is something a typical personal computer user never sees firsthand.
 3. Off-line storage is a system where the storage medium can be easily removed from the storage device. Off-line storage is used for data transfer and archival purposes.
- (iii) Network Storage: Network storage is any type of computer storage that involves accessing information over a computer network. It arguably allows to centralize the information management in an organization, and to reduce the duplication of information. It includes:
1. Network-attached storage is secondary or tertiary storage attached to a computer which another computer can access over a local-area network, a private wide-area network, or in the case of online file storage, over the Internet.
 2. Network computers are computers that do not contain internal secondary storage devices. Instead, documents and other data are stored on a network-attached storage.

Characteristics of storage are:

1. Volatility of information
2. Ability to access non-contiguous information
3. Ability to change information
4. Addressability of information
5. Capacity and Performance

For more details of the above points, students are advised to refer to the study material Chapter – 1.6.1 and 1.6.2.

7. (a) General-purpose 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. There are many types of general-purpose softwares, some of which are given below:
 - (i) Word Processor: A word processor (more formally a document preparation system) is a computer application used for the production (including composition, editing, formatting, and possibly printing) of any sort of printable material. Word processors are descended from early text formatting tools. Microsoft Word, WordPerfect, OpenOffice's Writer and Kword are some examples of computer word processing systems.
 - (ii) Spreadsheet Program: A spreadsheet is a rectangular table (or grid) of information. It is mostly used for financial purposes. Lotus 1-2-3, MS-Excel, Lotus Improv and Spreadsheet 2000 are some spreadsheet programs which are commonly used.
 - (iii) Database Management System: A database management system (DBMS) is a system or software designed to manage a database, and run operations on the data requested by numerous clients. Typical examples of DBMS use include accounting, human resources and customer support systems. Some DBMS examples are MS-Access, Oracle and SQL Server.
 - (iv) Internet Browser: An Internet Browser or a web browser is a software application that enables a user to display and interact with text, images, and other information typically located on a web page at a website on the World Wide Web or a local area network. Text and images on a web page can contain hyperlinks to other web pages at the same or different websites. Web browsers allow a user to quickly and easily access information provided on many web pages at many websites by traversing these links. Web browsers available for personal computers include Microsoft Internet Explorer, Mozilla Firefox, Apple Safari, Netscape and Opera.
 - (v) Electronic Mail: Abbreviated as e-mail or e-Mail or email, 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 e-mail each other.
- (b) Enterprise Resource Systems (ERPs) integrate (or attempt to integrate) all data and processes of an organization into a single unified system. A typical ERP system will use multiple components of computer software and hardware to achieve the integration. A key ingredient of most ERP systems is the use of a single, unified database to store data for the various system modules.

The term ERP originally implied systems designed to plan the utilization of enterprise-wide resources. Although the acronym ERP originated in the manufacturing environment, today's use of the term ERP systems has much broader scope. ERP systems typically attempt to cover all basic functions of an organization, regardless of the organization's business or charter. Business, non-profit organizations, governments, and other large entities utilize ERP systems. Benefits of an ERP system are:

1. A totally integrated system
2. Ability to streamline different processes and workflows
3. Ability to easily share data across various departments in an organization
4. Easy access and workflow
5. Once an ERP system is in place, usually all aspects of an organization can work in harmony instead of every single system needing to be compatible with each other. For large organizations, increased productivity and efficiency levels are the results.
6. Better tracking and forecasting
7. Lower costs
8. Improved customer service

In this way, ERP performs various tasks of an organization in well-structured manner. The introduction of an ERP system to replace two or more independent applications eliminates the need for interfaces previously required between systems, and provides additional benefits that range from standardization and lower maintenance (one system instead of two or more) to easier and/or greater reporting capabilities (as all data is typically kept in one database).

8. (a) System designers choose to organize, access, and process records and files in different ways depending on the type of application and the needs of users. The manner in which files are organized on the storage device is called file organization. The three commonly used file organizations used in business data processing applications are – sequential, direct and indexed sequential organizations. The selection of a particular file organization depends upon the type of application.
 1. Serial: With serial organization, records are arranged one after another, in no particular order- other than, the chronological order in which records are added to the file. Serial organization is commonly found with transaction data, where records are created in a file in the order in which transactions take place. Records in a serially organized file are sometimes processed in the order in which they occur.
 2. Sequential files: In a sequential file, records are stored one after another in an ascending or descending order determined by the key field of the records. To access these records, the computer must read the file in sequence from the

beginning. To locate a particular record, the computer program must read in each record in sequence and compare its key field to the one that is needed. The retrieval search ends only when the desired key matches with the key field of the currently read record.

3. Direct Access File Organization: Direct file organization allows immediate direct access to individual records on the file. The most widely used direct access techniques are:

- (a) Direct Sequential Access
- (b) Random Access

Direct sequential access can be further classified into

- (1) Self (Direct) Addressing Method
- (2) Indexed-Sequential File Organization

Self (Direct) Addressing Method: Under self direct addressing, a record key is used as its relative address. Therefore, the record's address can be computed directly from the record key and the physical address of the first record in the file. The advantage of Self-addressing is that there is no need to store an index. The disadvantage is that the records must be of fixed length and if some records are deleted, their storage space remains empty.

Indexed-Sequential File Organization: The indexed sequential file organization or indexed sequential access method (ISAM) is a hybrid between sequential and direct access file organizations. The records within the file are stored sequentially but direct access to individual records is possible through an index.

Random Access Organization: In this method, transactions can be processed in any order and written at any location through the stored file. To access a record, prior records need not be examined first. The CPU can go directly to the desired record using randomizing procedure without searching all the others in the file. The technique provides for converting the record key number to a physical location represented by a disk address through a computational procedure.

- (b) Following factors determine the best file organization for a particular application:

1. File volatility: It refers to the number of additions and deletions to the file in a given period of time. The payroll file for a construction company where the employee roster is constantly changing is a highly volatile file. In this situation, perhaps sequential file organization would be appropriate if there were no interrogation requirements.
2. File activity: It is the proportion of master file records that are actually used or accessed in a given processing run. At one extreme is the real-time file where each transaction is processed immediately and hence at a time, only one

master record is accessed. This situation obviously requires a direct access method. At the other extreme is a file, such as a payroll master file, where almost every record is accessed when the weekly payroll is processed. There, a sequentially ordered master file would be more efficient.

3. File interrogation: It refers to the retrieval of information from a file. If the retrieval of individual records must be fast to support a real-time operation such as airline reservation then some kind of direct organization is required. If, on the other hand, requirements for data can be delayed, then all the individual requests or information can be batched and run in a single processing run with a sequential file organization.
4. File size: Large files that require many individual references to records with immediate response must be organized under some type of direct access method. On the other hand, with small files, it may be more efficient to search the entire file sequentially or, with a more efficient binary search, to find an individual record than to maintain complex indexes or complex direct addressing scheme.

Payroll records of all employees should be stored sequentially since all records are to be accessed for payroll processing, direct accessing is not required.

9. (a) The three traditional database structures are:

1. Hierarchical Database Structure: In a hierarchical database structure, records are logically organized 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. There can be many levels of node records in a database. Features of hierarchical database are as follows:
 - (i) Less flexible because the hierarchy of records is to be determined beforehand.
 - (ii) Queries that require relationships not implemented in the database may be difficult.
 - (iii) Use of query language to solve the problem may prove to be very time consuming.
 - (iv) Usually processes structured day-to-day operational data rapidly.
 - (v) Records that do not have a natural, hierarchical relationship do not fit within the structure.
2. Network Database Structure: A network database structure views all records in sets. Each set is composed of an owner record and one or more member records. Thus, the network model implements the one-to-one and the one-to-many record structures. However, unlike the hierarchical mode, the network

model also permits a record to be a member of more than one set at one time. This feature allows the network model to implement the many-to-one and the many-to-many relationship types. Network data structures can be entered and traversed more flexibly. 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. Record relationships are usually structured to fit the processing needs of large batch reports. However, ad hoc requests for data, requiring record relationships not established in the data model, may not be very swift at all, and in some cases, they may not be possible.

3. **Relational Database Structure:** A relational database is structured into a series of two-dimensional tables. Each row in the table is really a record and each column represents one type of data element. Relational databases allow the manager flexibility in conducting database queries and creating reports. The links between data elements in a relational database do not need to be made explicit at the time the database is created since new links can be structured at any time. Also, multiple records can be processed simultaneously.
- (b) A Client-server database 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. The computational functions are shared in such a way that the server does all such higher level functions which it alone can do leaving the client to perform low level functions. A client-server database can be classified into 2-tier, 3-tier and n-tier models. The system is scalable in as much as clients may be added or removed and the shared resources may be relocated to a larger and faster server or to multiple servers. This type of client-server database is a 2-tier model. In 3-tier and n-tier client-server database designs, there is an application server tier between the data server tier and the client tier. Client tier is responsible for data presentation, receiving user events and controlling the user interface. Application tier handles the business logic, protecting the data from direct access by the clients. Data server tier is responsible for data storage.

A knowledge database system provides functions to define, create, modify, delete and read data in a system. The type of data maintained in a database system historically has been declarative data describing the static aspects of the real world objects and their associations. A database system can also be used to maintain procedural data describing the dynamic aspects of the real world objects and their associations, for example, several amended versions of enactments in the field of labour laws to facilitate management decisions in pay negotiations. When both the declarative and procedural data are stored in a database it constitutes a knowledge database with more powerful data maintenance.

10. (a) Limitations of the traditional computing models:

- (i) **Mainframe architecture:** In mainframe system, all intelligence is within the central host computer (processor). Users interact with the host through a dumb terminal that captures keystrokes and sends that information to the host. Data and other external resources can be easily shared. A limitation of mainframe software architectures is that they do not easily support graphical user interfaces or access to multiple databases from geographically dispersed sites. They cost literally thousands of times more than PCs, but they sure don't do thousands of times more work.
- (ii) **Personal Computers:** Disconnected, independent personal computing model. The processing load is removed from a central computer. Processing is done in individual computers. Disconnected personal workstation users cannot share data as well as expensive resources such as disk drives, printers, modems, and other peripheral computing devices.
- (iii) **File sharing architecture:** The original PC networks were based on file sharing architectures, where the server downloads files from the shared location to the desktop environment. The server directs the data while the workstation processes the directed data. The server will send the entire file over the network even though the workstation only requires a few records in the file to satisfy the information request. It does not support data concurrence (simultaneous access to a single data set by multiple users). If many workstations request and send many files in a LAN, the network can quickly become flooded with traffic, creating a block that degrades overall system performance.

Need for Client Server Model:

Client server technology intelligently divides the processing work between the server and the workstation. The server handles all the global tasks while the workstation handles all the local tasks. The server only sends those records to the workstation that are needed to satisfy the information request. Network traffic is significantly reduced. The result of this system is that is fast, secure, reliable, efficient, inexpensive, and easy to use.

Benefits of the Client Server technology:

- ◆ Reduce the total cost of ownership
- ◆ Increased productivity
- ◆ End-user productivity
- ◆ Developer productivity
- ◆ Maintenance requires less manpower
- ◆ Expenses of hardware and network reduced
- ◆ Easy access to data

- ◆ Ease of porting applications
- ◆ Reduce the cost of client's computer
- ◆ Easy to add new hardware to support new systems
- ◆ Long term cost benefits for development and support

For more details of the above points, students are advised to refer to the study material Chapter – 3.8.

(b) ISO has facilitated communication of heterogeneous hardware or software platforms with each other with the help of following seven layers of functions with their associated controls. Each of the seven layers uses different protocols.

1. 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.
2. 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.
3. Layer 3 or Network Layer makes a choice of the physical route of transmission of say, a message packet; also creates a virtual circuit for upper layers to make them independent of data transmission and switching. It also establishes, maintains, terminates connections between the nodes, and ensures proper routing of data.
4. Layer 4 or Transport Layer ensures reliable transfer of data between user processes, assembles and disassembles message packets, and provides error recovery and flow control. Multiplexing and encryption are undertaken at this layer level.
5. Layer 5 or Session Layer establishes, maintains and terminates sessions (dialogues) between user processes. Identification and authentication are undertaken at this layer level.
6. Layer 6 or Presentation Layer controls on-screen display of data and transforms data to a standard application interface. Encryption, data compression can also be undertaken at this layer level.
7. Layer 7 or Application Layer provides user services such as file transfer, file sharing, etc. Database concurrency and deadlock situation controls are undertaken at this layer level.

For more details of the above points, students are advised to refer to the study material Chapter – 3.6.8.

(c) In 3-tier architecture, the application server tier works in between the data server tier and the client tier. The tiers are bound together logically and can run on the same physical machine. Each tier is responsible to perform certain tasks like:

Client-tier: It is responsible for the presentation of data, receiving user events and controlling the user interface.

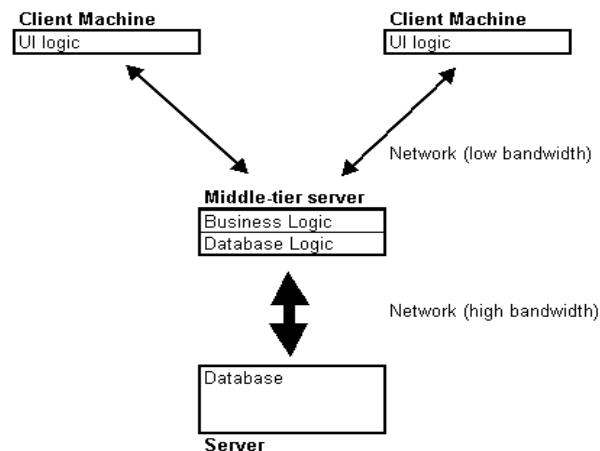
Application-server-tier: It is responsible for all the business logic. This tier protects the data from direct access by the clients.

Data-server-tier: This tier is responsible for data storage.

Advantages of 3-tier architecture:

- ◆ Clear separation of user-interface-control and data presentation from application-logic:
- ◆ Dynamic load balancing
- ◆ Easier and faster change management

In n-tier architecture,



the client program has only UI code. The UI code talks, via a network, to the "middle tier" on which the business and database logic sits. In turn the middle tier talks, via a network, to the database. In practice the middle tier can be placed, if necessary, on the same machine as the database.

In either architecture the data "traffic" is highest between database logic and database server. This means that the network infrastructure that connects the database logic with the database server needs to be very high bandwidth. The advantages of a multi-tier architecture are:

1. Forced separation of UI and business logic
2. Low bandwidth network
3. Business logic sits on a small number (may be just one) of centralized machines

4. Enforced separation of UI and business logic.
11. (a) 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. There are two common types of VPN:
 - (i) Remote-access VPN: Remote-access, also called a virtual private dial-up network (VPDN), is a user-to-LAN connection can be used by an organization that has employees who need to connect to the private network from various remote locations. The enterprise service provider (ESP) sets up a network access server (NAS) and provides the remote users with desktop client software for their computers. The telecommuters can then dial a toll-free number to reach the NAS and use their VPN client software to access the corporate network. Remote-access VPNs permit secure, encrypted connections between an organization's private network and remote users through a third-party service provider.
 - (ii) Site-to-Site VPN: Through the use of dedicated equipment and large-scale encryption, a company can connect multiple fixed sites over a public network such as the Internet. Site-to-site VPNs can be one of two types:
 - ◆ Intranet-based: If a company has one or more remote locations that they wish to join in a single private network, they can create an intranet VPN to connect LAN to LAN.
 - ◆ Extranet-based: When a company has a close relationship with another company, they can build an extranet VPN that connects LAN to LAN, and that allows the various companies to work in a shared environment.
 - (b) There are three different types of data communication modes:
 - (i) Simplex: A simplex communication mode permits data to flow in only one direction. A terminal connected to such a line is either a send-only or a receive-only device. Simplex mode is seldom used because a return path is generally needed to send acknowledgements, control or error signals.
 - (ii) Half-duplex: Under 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 time.
 - (iii) Full-duplex: A full duplex connection can simultaneously transmit and receive data between two stations. It is most commonly used communication mode. A full duplex line is faster, since it avoids the delay that occur in a half-duplex mode each time the direction of transmission is changed.
 - (c) 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 16kbps or 64kbps, 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 16kbps D channel for a total of 144kbps and is suitable for individual users. PRI consists of twenty three B channels and one 64kbps D channel for a total of 1536kbps and is suitable for users with higher capacity requirements.

Advantages of ISDN are:

- (i) It allows multiple digital channels to be operated simultaneously through the same regular phone cable meant for analog signals. The digital scheme permits a much higher data transfer rate than analog lines. The amount of time it takes for a communication to start up or the latency time period is about half of that of an analog line.
 - (ii) With ISDN it is possible to combine many different digital data sources and have the information routed to the proper destination. In a digital line it is easier to keep noise and interference out even after combining these signals.
 - (iii) The phone company sends a ring voltage signal to ring the bell which is an In Band signal. However ISDN sends a digital packet on a separate channel which is an Out Band signal without disturbing the established connections, without taking any bandwidth from data channels and setting up the call much faster. Then the ISDN phone equipment makes intelligent decisions on how to direct the call.
 - (iv) Usually the telephone company provides the BRI customers with a U interface which is nothing but a single pair of twisted wire from the phone switch. It can transmit full duplex data and therefore only a single device can be connected with a U interface, which is known as Network Termination 1.
12. (a) Computer-to-computer exchange of documents can be achieved through EDI (Electronic Data Interchange). EDI is the transmission, in a standard syntax, of unambiguous information of business or strategic significance between computers of independent organizations. The users of EDI do not have to change their internal data bases. However, users must translate this information to or from their own computer system formats, but this translation software has to be prepared only once.

The computer-to-computer transfer can be direct, between two companies using an agreed upon data protocol, or it can be performed by a third-party service vendor. The format for data transmission between trading partners via common carrier, is governed by a predetermined and institutionally agreed upon set standards. This electronic information exchange reduces data entry errors by eliminating repetitive tasks and lowers administrative overhead costs associated with paper-based processing methods. EDI works this way:

1. Data from the sender's application is translated into a standard format.

2. Then, it is transmitted over communication lines to the receiver.
3. Finally, it is re-translated by the receiver's application.

For more details of the above points, students are advised to refer to the study material Chapter – 4.10.

- (b) The various types of electronic payments are:
- (i) Credit cards: In a credit card transaction, the consumer presents 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. Credit cards can be handled on line in two different ways:
 - ◆ Sending unencrypted credit card numbers over the Internet
 - ◆ 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 yet 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 will likely slow down both consumer and business acceptance of using credit cards for making purchases on the Internet.
 - (iii) Secured Electronic Transaction (SET): SET 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 (JEPI) is an attempt to standardize payment negotiations. On the buyer's side (the client side), it serves as an interface that enables a Web browser to use a variety of payment protocols. On the merchant's side (the server side), it acts between the network and transport layers to pass off the incoming transactions to the proper transport protocol and proper payment protocol (such as SET).
 - (v) Electronic Cheques: Following two systems have been developed to let consumers use electronic cheques to pay Web merchants directly.
 - (a) By the Financial Services Technology Corporation (FSTC)
 - (b) By CyberCash: An electronic cheque functions as a message to the sender's bank to transfer funds, and, the message is given initially to the receiver who, in turn, endorses the cheque and presents it to the bank to obtain funds. Encryption or digital certificates can be used to protect against fraud. Electronic cheque can be delivered either by direct transmission over a network, or by electronic mail.

- (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 there: contact cards, contactless cards and combi cards.
- (vii) **Electronic Purses:** Electronic purse is very similar to a pre-paid card. While making purchases, customers pass their cards through a vendor's point of sale terminal. No credit check or signature is needed. Validation is done through a Personal Identification Number (PIN). Once the transaction is complete, funds are deducted directly from the cards and transferred to the vendor's terminal.
- (c) **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. The technology got its unusual name in honor of Harald Bluetooth, king of Denmark in the mid-tenth century. Bluetooth requires that a low-cost transceiver chip be included in each device. The transceiver transmits and receives in a previously unused frequency band of 2.45 GHz that is available globally. In addition to data, up to three voice channels are available. Each device has a unique 48-bit address from the IEEE 802 standard. Connections can be point-to-point or multipoint. The maximum range is 10 meters. Data can be exchanged at a rate of 1 megabit per second (up to 2 Mbps in the second generation of the technology). A frequency hop scheme allows devices to communicate even in areas with a great deal of electromagnetic interference. Built-in encryption and verification is provided.

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.

13. (a) The following reasons exist to explain the Internet's emergence as the foundation for the world's new information infrastructure:
 - (i) **Universality** - Any business using the Internet can interact with any other business using the Internet, whereas, earlier networking technologies allowed businesses to ship goods to only those companies connected to the same network.
 - (ii) **Reach** - The Internet is everywhere, in the large cities and small towns throughout the modern and developing world.
 - (iii) **Performance** - Internet can handle visual images, audio clips, and other large electronic objects. It provides its users with a high-function window to the world, in addition to handling everyday networking tasks such as electronic mail.
 - (iv) **Reliability** - The design concepts for the Internet came out of U.S. Department

of Defense. Hence, Internet technology is highly robust and reliable, in spite of significant differences in the extent to which various Internet service providers actually implement and ensure this reliability.

- (v) Cost - Compared with alternative networking technologies, Internet costs are surprisingly low.
- (vi) Momentum – Many individuals are already connected to the Internet, and business use is increasing at a dramatic rate.
- (b) 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. It is a corporate level strategy which focuses on creating and maintaining lasting relationships with its customers.

To be effective, the CRM process needs to be integrated end-to-end across marketing, sales, and customer service. A good CRM program needs to:

- (i) Identify customer success factors
- (ii) Create a customer-based culture
- (iii) Adopt customer-based measures
- (iv) Develop an end-to-end process to serve customers
- (v) Recommend what questions to ask to help a customer solve a problem
- (vi) Recommend what to tell a customer with a complaint about a purchase
- (vii) Track all aspects of selling to customers and prospects as well as customer support
- (c) 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.

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 vs. 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.
14. (a) Computer programming is a process which results in the development of a computer program. It is sub-divided into six separate phases.
- (i) Program analysis: In this stage, the programmer ascertains these things for a particular application - the outputs required, the inputs available and the processing. The programmer then determines whether the proposed application can be or should be programmed at all.
 - (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. Input, output, 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. Each coded instruction is then entered onto a magnetic media using a key board. This program is then translated into the machine language of the computer by an interpreter or a compiler, both of which have diagnostic capabilities.
 - (iv) Program debugging: The assembly compilation run can detect only few syntax errors. Therefore, before putting the program into use there is a real necessity to debug it. Towards this purpose, the programmers devise a set of test data transactions to test the various alternative branches in the program. The results are then compared with the ones derived manually prior to computer processing, to find 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.
 1. The program specifications i.e., what it is supposed to do.
 2. The program descriptions i.e., input, output and file layout plans, flowcharts etc.
 3. The test data employed in debugging the program.
 4. The operation manual which details the operating instructions for the computer operator.
 5. The maintenance documentation i.e., 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 existing programs. Maintenance programmers are entrusted with this task.
- (b) Program analysis is an important step in computer programming in which the computer programmer seeks the answer to the question "What is the program

supposed to do?" Thus, first the programmer has to define the problem. The problem needs to be defined and set for the computer in such a way that every possible alternative is taken care of. The computer procedure must be sufficiently detailed at each stage of a computation to permit the required calculations to be performed. The procedure for generating a sequence of Fibonacci numbers (that are less than 100) serves as an example:

- (i) Assign the values: 0 to N1, 1 to N2. (continue with step (ii))
- (ii) Write the value of N2. (continue with step (iii))
- (iii) Add N1 and N2 and assign the resulting value to N3. (continue with step (iv))
- (iv) If N3 is less than or equal to 100, then go to step (vi). If N3 is greater than 100, continue with step (v).

Stop.

- (vii) Write the value of N3. (continue with step (vii))
- (viii) Assign the value of N2 to N1. (continue with step (viii))
- (ix) Assign the value of N3 to N2. (continue with step (ix))
- (x) Go to step (iii).

Algorithm is a finite list of instructions specifying a sequence of operations and that give the answer to any problem of a given type. An algorithm exists for each computational problem that has a general solution. The algorithm for generating a sequence of Fibonacci numbers (that are less than 100) serves as an example:

- (i) Set N1 to 0.
- (ii) Set N2 to 1.
- (iii) Write down N2.
- (iv) Set N3 equal to $N1 + N2$.
- (v) If N3 is greater than 100, then stop the calculations.
- (vi) Write down N3.
- (vii) Replace N1 by N2.
- (viii) Replace N2 by N3.
- (ix) Continue the calculations with step 4.

- (c) A flowchart helps in describing a complex problem. It is a diagrammatic representation of the sequence of steps involved in solving a problem. 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

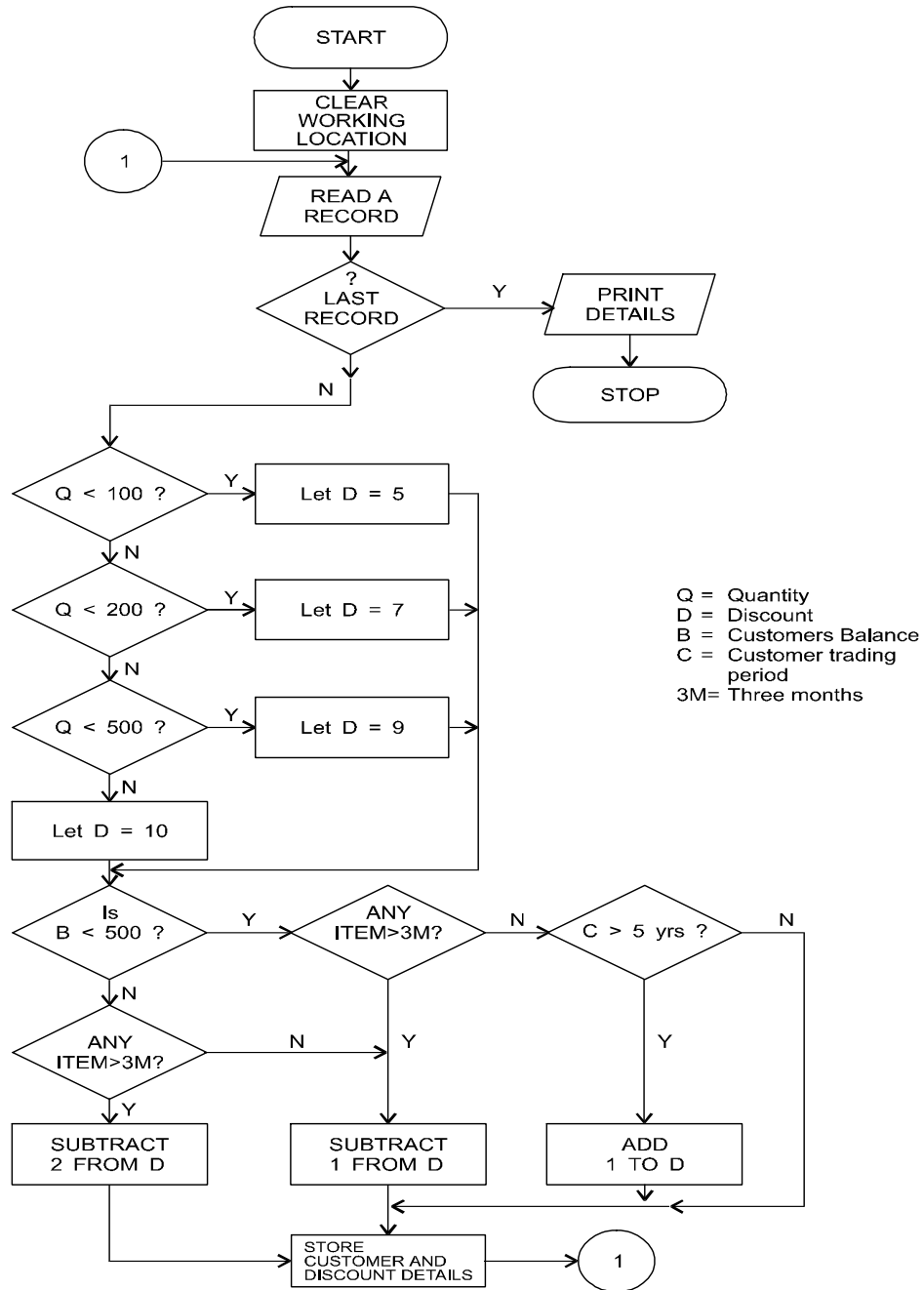
categories as below:

- (i) System outline charts (Global map): These charts merely lists the inputs, files processed and outputs without regard to any sequence whatever.
- (ii) System flowcharts (National map): It is designed to present an overview of the data flow through all parts of a data processing system. It represents the flow of documents, the operations or activities performed and the persons or work-stations. It also reflects the relationship between inputs, processing and outputs. In a computer system, the system flow chart consists of mainly the following:
 - ◆ the sources from which input data is prepared and the medium or device used
 - ◆ the processing steps or sequence of operations involved
 - ◆ the intermediary and final output prepared and the medium and devices used for their storage
- (iii) Run flowcharts (State map): 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.
- (iv) Program flowcharts (District map): These 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. The most detailed program flowchart would have exactly one instruction for each symbol in the flowchart i.e., coding would be simple and straightforward but the flowchart being biggish would defeat its purpose of showing the flow of data at a glance.

15. The required flowchart is given on next page.

16. Decision Table

	Admitting students	R1	R2	R3	R4	R5
C1	Done KG from a recognized school	Y	Y	N	N	N
C2	Resides in Delhi	Y	N	--	--	--
C3	Cleared the admission test	--	--	Y	N	N
C4	Parents are well-educated	--	--	--	Y	N
A1	Admit	X		X	X	
A2	Reject		X			X



17. (a) Workstations: A workstation looks like a personal computer and is typically used by one person. They are classified between minicomputers and microcomputers in terms of their processing power. They are based on reduced instruction set computing (RISC) CPU architecture, which results in faster processing of instructions. Some times workstation is used to refer to any computer or terminal that is connected to another computer. Although this was once a common meaning of the term, it has become outdated. These days, a workstation is powerful RISC - based computer that can work independently or as a terminal.
- (b) Cards: Cards are components added to computers to increase their capability. The cards can be classified into various categories as:
 - (i) Sound cards allow computers to produce sound like music and voice. The older sound cards were 8 bit then 16 bit then 32 bit. They allow for more complex music and music production.
 - (ii) Graphic cards allow computers to display colours. The first colour card was 2 bit card which produced 4 colours [CGA]. Next came 4 bit allowing for 16 [EGA and VGA] colours. Then came 16 bit allowing for 1064 colours and then 24 bit which allows for almost 17 million colours and now 32 bit standard, allowing monitors to display almost a billion separate colours.
 - (iii) Video cards allow computers to display video and animation. Some video cards allow computers to display television as well as capture frames from video. A video card with a digital video camera allows computers users to produce live video. A high speed or network connection is needed for effective video transmission.
 - (iv) Network cards allow computers to connect together to communicate with each other. Network cards have connections for cable, thin wire or wireless networks.
- (c) 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. Components of BCP 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 covering 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.

The Phase-II of a BCP involves determination of minimum resources necessary, review operations between current practices and backup procedures.

The Phase-III of a BCP involves identification of most appropriate recovery solutions and preparing a list of alternatives.

The Phase-IV of a BCP involves the plan preparation.

The Phase-V of a BCP involves testing BCP and reviewing the test results.

The Phase-VI of a BCP involves maintenance by BCP Coordinator.

For more details of the above points, students are advised to refer to the study material Chapter – 3.11.9.

- (d) 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. Special printing font is used 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 for processing cheques.

Advantages of MICR:

- ◆ MICR possesses a very high reading accuracy.
- ◆ Cheques 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 favour from business.
- ◆ Damaged documents, cheques not encoded with amount etc. have still to be clerically processed.

- (e) Enterprise Marketing Automation: Enterprise marketing automation (EMA) provides information about the business environment, including competitors, industry trends, and macro environmental variables. It is the execution side of campaign and lead management. The intent of EMA applications is to improve marketing campaign efficiencies. Functions include demographic analysis, variable segmentation, and predictive modeling occurs on the analytical (Business Intelligence) side. Integrated CRM (Customer Relationship Management) software is often also known as front office solutions. This is because they deal directly with the customer. Many call centers use CRM software to store all of their customer's details. When a customer calls, the system can be used to retrieve and store information relevant to the customer. By serving the customer quickly and efficiently, and also keeping all information of a customer in one place, a company aims to make cost savings, and also encourage new customers. CRM solutions can

also be used to allow customers to perform their own service via a variety of communication channels.

- (f) **Communication Services:** An organization that wishes to transmit data uses one of the common carrier services to carry the messages from station to station. The communication services can be classified into three categories as below:

Narrow band Service - Usually, this service is used where data volume is relatively low; the transmission rates usually range from 45 to 300 bits per second. Examples of this are the telephone companies' typewriters exchange service (TWX) and Telex service.

Voice band Services - Voice band services use ordinary telephone lines to send data messages. Transmission rates vary from 300 to 4,800 bits per second, and higher.

Wide band Services - Wide band services provide data transmission rates from several thousands to several million bits per second. These services are limited to high-volume users. Such services generally use coaxial cable or microwave communication.

Communication services may be either leased or dial-up. A leased communication channel, which gives the user exclusive use of the channel, is used where there are continuing data-transmission needs. The dial-up variety requires the person to dial the computer.

- (g) **Data warehouse:** A data warehouse is a computer database that collects, integrates and stores an organization's data with the aim of producing accurate and timely management information and supporting data analysis. These data warehouses were able to bring in data from a range of different data sources. Data warehouses have evolved through several fundamental stages:

1. Offline Operational Databases
2. Offline Data Warehouse
3. Real-Time Data Warehouse
4. Integrated Data Warehouse

The primary components of a data warehouse are: Data Source, Data Transformation, database (warehouse), reporting, metadata, operations.

There are many advantages to using a data warehouse, some of them are:

1. Enhances end-user access to a wide variety of data.
2. Increases data consistency.
3. Increases productivity and decreases computing costs.
4. Is able to combine data from different sources, in one place.
5. It provides an infrastructure that could support changes to data and replication of the changed data back into the operational systems.

For more details of the above points, students are advised to refer to the study material Chapter – 2.17.

- (h) **Webcasting:** Webcasting or Push Technology allows users to passively receive broadcast information rather than actively search the Web for information. It allows users to choose from a menu of sources, specifying what kind of information they want to receive. Once selected, the information is automatically forwarded to the user. Internet news services are an example of push technology. Users can also download software, select the frequency with which they will receive services, and subscribe to a variety of information sources. Push technology differs from the traditional uses of the Internet. The Internet is, for the most part, a pull environment where a user opens a browser application and searches for information. While there are millions of Web pages, they are essentially dormant until they are located and the user successfully navigates his or her way to the correct destination. As any current Web user knows, this navigation process can sometimes be frustrating and time consuming. Push technology eliminates this frustration.
- (i) **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 up to one thousandth of an inch. Plotters may be driven on-line or 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.

- (j) **The Bullwhip Effect:** The Bullwhip Effect or Whiplash Effect is an observed 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, and they are rarely perfectly accurate. Because forecast errors are a 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 has greater observed 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 you get from the end-consumer. Factors contributing to the Bullwhip Effect:

- (i) Forecast Errors
 - (ii) Lead Time Variability
 - (iii) Batch Ordering
 - (iv) Price Fluctuations
 - (v) Product Promotions
 - (vi) Inflated Orders
 - (vii) Methods intended to reduce uncertainty, variability, and lead time
 - (viii) Vendor Managed Inventory (VMI)
 - (ix) Just In Time replenishment (JIT)
 - (x) Strategic Partnership (SP)
- (k) **Data Mining:** Data mining is concerned with the analysis of data and the use of software techniques for finding patterns and regularities in sets of data. It is the computer, which is responsible for finding the patterns by identifying the underlying rules and features in the data. Data mining analysis tends to work from the data up and the best techniques are those developed with an orientation towards large volumes of data, making use of as much of the collected data as possible to arrive at reliable conclusions and decisions. The analysis process starts with a set of data, uses a methodology to develop an optimal representation of the structure of the data during which time knowledge is acquired. Once knowledge has been acquired this can be extended to larger sets of data working on the assumption that the larger data set has a structure similar to the sample data. Data mining is divided in following phases:
1. Selection: selecting or segmenting the data according to some criteria.
 2. Preprocessing: removing certain information which is deemed unnecessary and which may slow down queries.
 3. Transformation: the data is not merely transferred across but transformed in that overlays may add; the data is made useable and navigable.
 4. Data mining: this stage is concerned with the extraction of patterns from the data.
 5. Interpretation and evaluation: the patterns identified by the system are interpreted into knowledge which can then be used to support human decision-making.