

Instructions for Candidates:

1. All questions are compulsory.
2. Answer should be brief and all parts of a question be answered together.

Q. 1. (a) State True/False:

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(i) ROM is a volatile memory.

(ii) A network is interconnection of computers that enable the users to share network resources.

(iii) A foreign key always uniquely identifies a record.

(iv) Chart created on the worksheet is called embedded chart.

Ans. (i) False. ROM is a non-volatile memory because its contents are retained even after the power is switched off.

(ii) **True.** A network is interconnection of computers that enable the users to share network resources.

(iii) **False.** A Primary key always uniquely identifies a record.

(iv) **True.** Chart created on the worksheet is called embedded chart.

(b) Answer in one line:

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(i) Define topology.

(ii) What is folder?

(iii) What is the use of random sampling?

Ans. (i) Topology. It is the way in which constituent parts are interrelated or arranged in a network.

(ii) **Folder.** A folder is a special type of file in a computer's file system which contains other files and folders.

(iii) **Use of Random sampling.** Random sampling is the basic sampling technique where a group of subjects (a sample) is selected for study from a larger group (a population) such that each member of the population has an equal chance of being included in the sample.

Q. 2. What do you understand by network topology? Describe three commonly used network topologies.

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Ans. Network topology refers to the physical or logical layout of a network. Network topology is the geometric arrangement of the computers in a network. Three commonly used network topologies include – star, ring and bus.

1. Star Network. The star network is frequently used to connect one or more small computers or peripheral devices to a large host computer or CPU. Such a network is also called a *store and forward network*. If client computer C1 wants to send a message to another client C4, the message addressed to C4 is received by the server. The server examines the address of the message and forwards it to C4. Observe that the central server can be powerful and provides services to all the clients. The primary advantage of this connection is that each computer has an exclusive connection to the server and bandwidth is not shared. The main disadvantages are that server can create a "traffic jam" and that if the server fails,

the entire network is down. Star network is frequently used in a LAN to connect several microcomputers to a central unit that works as a communications controller. Another common use of the star network is as a LAN to connect several microcomputers to a mainframe computer that allows access to an organization's database.

2. Ring Network. The ring network is a local-area network (LAN) whose topology is a ring—can be as simple as a circle or point-to-point connections of computers at dispersed locations, with no central host computer or communications controller. That is, all of the nodes are connected in a closed loop. Messages travel around the ring, with each node reading those messages addressed to it. One of the advantages of ring networks is that they can span larger distances than other types of networks, such as bus networks, because each node regenerates messages as they pass through it. Access and control of ring networks are typically maintained by a "token-passing" system. The Token-Ring network is designed to link all types of computers together, including not only personal computers but also possibly mini computers and mainframes. A Token-Ring network resembles a merry-go-round. To deliver a message, you would hand your addressed note to a rider (the token) on the merry-go-round, who would drop it off at the appropriate place.

3. Bus Network. Bus networks are similar to ring networks except that the ends are not connected. All communications are carried on a common cable or bus and are available to each device on the network. All the devices are connected sequentially to the same transmission line. Access and control of bus networks are typically maintained by a method called contention, whereby if a line is unused, a terminal or device can transmit its message at will, but if two or more terminals initiate messages simultaneously, they must stop and transmit again at different intervals.

Or

What is a Payment Gateway? How does it work?

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Ans. Payment Gateway. A payment gateway is an e-commerce service that processes credit card payments for online and traditional brick and mortar stores. Payment gateways facilitate these transactions by transferring key information between payment portals such as web-enabled mobile devices/websites and the front end processor/bank. Payment gateways are financial intermediaries that fulfill a vital role in e-commerce transaction process, authorizing payments between merchant and customer.

A payment gateway can be set up by a bank but it need not necessarily be a bank. It needs software which is linked to customers and suppliers and which is used to set up all other validations and checks. A typical e-commerce transaction consists of bill presentment, bill payment and settlement. The payment gateway software needs to provide all these and more.

Working of Payment Gateway. The gateway carries out a series of tasks when a customer orders a product or service from a merchant. The process works in much the same way as a physical point of sale terminal in a shop or restaurant—

- A customer makes an order and enters their card details.
- If the order is made online, these details are encrypted and sent to the merchant's web server.

- The merchant then forwards the transaction details to their Payment Gateway, which are then sent to the merchant's bank, and onto the card association (VISA or MasterCard).
- The card issuing bank then receives the authorisation request and carries out a number of checks before sending a response code to the Payment Gateway.
- The gateway forwards the response onto the website where it is interpreted and relayed to the merchant and the card holder and this all takes place in about 2-3 seconds.
- The merchant can fulfil the order and the money from the sale is deposited into their account.

Q. 3. How traditional file system is different from database system? 6

Ans. *Traditional file system vs. Database approach.*

In Traditional file management, each functional area develops its own specialized applications. 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 that limit its efficiency and effectiveness for end user applications. Since each application has its own data file, the same data may be recorded and stored in many files leading to redundant data items. Data redundancy leads to data inconsistency as the same data appears in more than one file. Other disadvantages of the traditional file system include lack of data integration, program and data dependence, poor data control, limited data sharing and so on. Because of these reasons, now-a-days, databases are preferred over traditional file systems.

The Database Management Systems (DBMS) integrate the independent data files into a corporate wide single logical entity. Such integration leads to the following significant benefits over traditional file approach that justifies the use of database approach:

1. **Self describing nature of database system.** In traditional file processing, data definition is typically part of the application programs, while DBMS software can access diverse databases by extracting the database definitions from the catalog maintained as a part of the file and then using these definitions.
2. **Sharing of resources (Data sharing).** Under DBMS, integrating tables created by several users in a central database makes it possible for sharing data throughout the organisation.
3. **Data-program Independence.** The catalog maintained under database approach as a part of the file, provides database definitions thus ensuring data-program independence. Whereas under traditional file approach, data definition is typically part of application programs, which makes data and program dependent on each other.
4. **Redundancy control.** The file management system entails generous copying of files across the systems. Such an approach leads to multiple redundancies of data. Redundancy control that can be achieved by the

use of the database approach leads to effectiveness of data administration.

5. **Multiple view.** Unlike the traditional file management system, it is possible under the database approach to create multiple mirror images of the data as per the requirement of individual user.
6. **Security.** Database approach offers a far easier security control mechanism than any of the file processing systems. Also, a central administration of data can ensure that integrity of data can be maintained.

Or

What is Operating System (OS)? Explain the types of operating system based on processing capability. 6

Ans. An operating system is a collection of programs that supervises all the operations of a computer. Each computer must be under the control of an operating system before it can execute any program. It acts as an interface between users and the hardware of a computer system.

Types of Operating Systems based on processing capability:

1. **Multiprogramming Operating Systems.** Multiprogramming operating systems execute multiple programs in interleaved fashion or different time cycles. In such a system, more than one program resides in the computer's main memory. When one program is reading in data or outputting results (i.e., it is involved in I/O operations), another program can be executed. When both programs are involved in I/O operations, a third program can be executed. Thus, while one program is involved in I/O operations the CPU is not idle as it is executing another program. Multiprogramming ensures maximum utilization of CPU. Operating systems such as UNIX, Windows NT, LINUX, etc. support multiprogramming.
2. **Multi-tasking Operating Systems.** The term Multi-tasking describes any system that runs or appears to run more than one application program at one time. An effective Multi-tasking environment must provide many services both to the user and to the application program it runs. The most important of these are resource management which divides the computer's time, memory and peripheral devices among competing tasks and inter-process communication, which lets tasks coordinate their activities by exchanging information. The simplest form of Multi-tasking is called *serial Multi-tasking* or *context switching*. This is nothing more than stopping one program temporarily to work on another. While a program is running, the user can use the calculator and when the user stops using the calculator, the program continues running.
3. **Multiprocessing Operating Systems.** In multiprocessing, multiple CPUs perform more than one job at one time. In this approach, the instructions from different programs can be processed at the same time by different processors. The different processors execute instructions of the different programs all at the same time. This job scheduling is done by "front-end processors". Multiprogramming and multiprocessing are not mutually

exclusive. Some mainframes and super-minicomputers have multiple CPUs each of which can juggle several jobs.

4. **Multi-threading Operating System.** Multi-threading OS allows different parts of a single process called threads to run concurrently. The basic unit of CPU utilization in such a system is thread. Unlike processes, threads of a process share the same address space, i.e., the memory area allocated, same set of operating system resources such as open files etc. Use of threads simplifies programming of many applications. At a particular instance of time, a thread can be in any one of the several states—running, blocked, ready or terminated. When a new thread is created it uses the address space of its process therefore lesser overheads are involved in a multi-threading system. Also, resource sharing is more efficient among threads of a process than among processes.
5. **Multi-user Operating System.** A multi-user operating system allows simultaneous access to a computer system through two or more terminals. It is frequently associated with multiprogramming, but multi-user operating system does not imply multiprogramming or multitasking. A dedicated transaction processing system such as railway reservation system with hundreds of terminals under control of a single program is an example of multi-user operating system.
6. **Timesharing Operating Systems.** Timesharing Operating Systems is a computer environment that allows many users to share a computer at the same time. Many terminals are connected to a single computer. Most time sharing systems use time-slice (round robin) scheduling of CPU. In this approach, programs are executed with rotating priority that increases during waiting and drops after the service is granted. In order to prevent a program from monopolising the processor, a program executing longer than the system defined time-slice is interrupted by the operating system and placed at the end of the queue of waiting program. In a time sharing system, the CPU attends to each job for a fixed time slot. All jobs get a brief share of the CPU's time. This timeslot is typically 10 msecs. The CPU can change from one program to the next very rapidly and therefore every user feels that the computer is attending to his job only. Time sharing is a special case of multiprogramming, where a single CPU serves a number of users at interactive terminals.
7. **Real Time Operating System.** Real time operating system is used in environments where a large number of events mostly external to computer systems, must be accepted and processed in a short time or within certain deadlines. Examples of such applications are flight control, nuclear reactor control systems, real time simulations, military applications, etc. Primary objective of real-time system is to provide quick response times. User convenience and resource utilization are of secondary concern to real-time system. In the real-time system each process is assigned a certain level of priority according to the relative

importance of the event processes. The processor is normally allocated to the highest priority process among those which are ready to execute. Higher priority process usually pre-empt execution of lower priority processes. This form of scheduling called, *priority based pre-emptive scheduling*, is used by a majority of real-time systems.

Q. 4. What is DBMS? Explain its advantages and limitations?

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Ans. Database management system (DBMS) is a system software for creating and managing databases. It is a software that performs the functions of creating, modifying, deleting and adding data in files, and using this data to generate reports or answer queries in a database.

Advantages of DBMS:

1. **Controlling Redundancy:** In traditional file system, each application has its own private files, which cannot be shared between multiple applications. This can often lead to considerable redundancy in the stored data, which results in wastage of storage space. By having centralized database most of this duplication can be carefully controlled and can be avoided. It is not possible that all redundancy should be eliminated.
2. **Integrity can be enforced:** Integrity of data means that data in database is always accurate, such that incorrect information cannot be stored in database. A DBMS provides capabilities for defining and enforcing the constraints to provide data integrity.
3. **Inconsistency can be avoided:** In traditional file system, when the same data is duplicated and changes are made at one site, which is not propagated to the other site, it gives rise to inconsistency and the two entries regarding the same data will not agree. At such times the data is said to be inconsistent. So in the case of database systems, if the redundancy is removed, chances of having inconsistent data is also removed.
4. **Restricting unauthorized access.** When multiple users share a database, it is likely that some users will not be authorized to access all information in the database. *For example*, accounts office data is often considered confidential, and hence only authorized persons are allowed to access such data.
5. **Providing Backup and Recovery.** A DBMS must provide facilities for recovering from hardware or software failures. The backup and recovery subsystem of the DBMS is responsible for recovery. *For example*, if the computer system fails in the middle of a complex update program, the recovery subsystem is responsible for making sure that the database is restored to the state it was in before the program started executing.
6. **Concurrency Control.** DBMS systems provide mechanisms to provide concurrent access of data to multiple users. The database systems also prevent any loss of information or loss of integrity due to these concurrent accesses.

Disadvantages of DBMS:

1. **Complexity.** The provision of the functionality that is expected of a good DBMS makes the DBMS an extremely complex piece of software. Database designers, developers, database administrators and end-users must understand this functionality to take full advantage of it. Failure to understand the system can lead to bad design decisions, which can have serious consequences for an organization.
2. **Size.** The complexity and breadth of functionality makes the DBMS an extremely large piece of software, occupying many megabytes of disk space and requiring substantial amounts of memory to run efficiently.
3. **Performance.** DBMS is written to be more general, to cater for many applications rather than just one. The effect is that some applications may not run as fast as they used to.
4. **Higher impact of a failure.** The centralization of resources increases the vulnerability of the system. Since all users and applications rely on the availability of the DBMS, the failure of any component can bring operations to a halt.
5. **Cost of DBMS.** The cost of DBMS varies significantly, depending on the environment and functionality provided. There is also the recurrent annual maintenance cost.
6. **Additional hardware costs.** The disk storage requirements for the DBMS and the database may necessitate the purchase of additional storage space. Furthermore, to achieve the required performance it may be necessary to purchase a larger machine, perhaps even a machine dedicated to running the DBMS. The procurement of additional hardware results in further expenditure.

Or

Explain the following with example:

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- (i) Primary Key
- (ii) Alternate Key
- (iii) Secondary Key

Ans. (i) **Primary key.** A primary key is one or more fields (columns) whose value or values uniquely identify each record in a table. A primary key does not allow null values and must always have a unique value. A primary key is used to relate a table to foreign keys in other tables. For example in the following table of Student Details, the column Enrolment No. is the Primary key and it contains unique data.

StudentDetails

EnrolmentNo (Primary Key)	StudentName	Course	FatherName	Address
HR01/07	Anjali Gambhir	Economics (H)	A	Abc
HR02/07	Bhawana Aggarwal	Philosophy (H)	B	Xyz
HR03/07	Ajay Gulati	B.Com(H)	C	Mno

- (ii) **Alternate key.** An alternate key is a key associated with one or more columns whose values uniquely identify every row in the table, but which is not the primary key. For example, where the primary key for a table may be the employee id, the alternate key might combine the first, middle, and last names of the employee.
- (iii) **Secondary key.** A secondary key is made on a field that is to be indexed for faster searches. A table can have more than one secondary key. The main purpose of a database is to store and search for data. For example, in the StudentDetail table, the Course can be the secondary key.

