

# SANKAT MOCHAN DE. RA. MA. VI.

Janakpurdham - 4

## 1<sup>st</sup> Terminal Examination Question Solution 2079

Faculty: **Science**

Class: **I. Sc./I. Com XII**

F.M.: **75**

Subject: **Computer**

Time: **3:00 Hrs.**

P.M.: **27**

*Candidates are required to give their answers in their own words as far as practicable.*

### Group – A (7.5x4=30)

#### 1. Write a brief introduction to DBMS.

*A database management system (DBMS) refers to the technology for creating and managing databases. Basically, a software tool to organize (create, retrieve, update, and manage) data in a database.*

*The main aim of a DBMS is to supply a way to store and retrieve database information that is both convenient and efficient. By data, we mean known facts that can be recorded and that have embedded meaning. Usually, people use software such as DBASE IV or V, Microsoft ACCESS, SQL, or MySQL to store data in the form of a database. A datum is a unit of data. Meaningful data is combined to form information. Hence, information is interpreted as data - data provided with semantics. MS. ACCESS is one of the most common examples of database management software.*

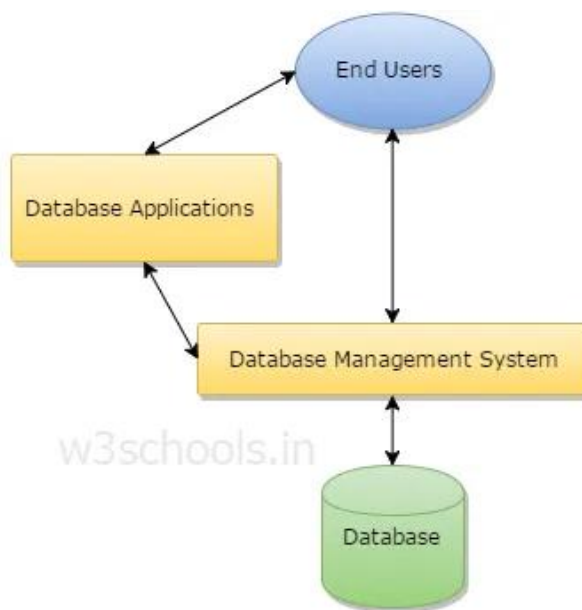
#### Components of DBMS:

**End Users:** Users may be of any kind such as DB administrator, System developer, or database users.

**Database application:** Database application may be Departmental, Personal, organization's and / or Internal.

**DBMS:** Software that allows users to create and manipulate database access.

**Database:** Collection of logical data as a single unit.



Components of a Database Management System

There are two types of DBMS:

**i.      *Structured Databases***

*Structure Databases are those Database System in which the Data are stored in the consistent and managed uniform format like tables or prespecified property and value pair form. This is the most common and traditional form of databases.*

**ii.     *Structureless Databases***

*Structureless Databases are those Database System in which the Data are not stored in any predefined structure like table or any form. Hence the data in this structure may be in the property value pair but may not be consistent and not all the row of the data may have the same length or same level of content. These Databases are referred to as NoSQL Databases.*

**2. What are the basic elements of a Communication System?**

*Communication is the act of transmission of information. Every living creature within the world experiences the necessity to impart or receive information, virtually unceasingly, with alternatives in the closed world. For communication to be successful, it's essential that the sender and the receiver perceive a standard language.*

*Humans have perpetually created endeavors to enhance the standard of communication with other human beings. Languages and the ways utilized in communication have been unbroken, evolving from prehistoric to fashionable times, to fulfil the growing demands in terms of speed and quality of information.*

*Communication System that relies on the electronics means is known as Electronic Communication Systems and similarly Digital Communication System if the electronics are digital which are mostly used these days.*

*The basic components of a communication system are*

- i.      Information Source*
- ii.     Transmitter*
- iii.    Communication Channel*
- iv.     Receiver*
- v.      Destination*

**Information Source:**

*We know that communication systems are the art of information exchange. Therefore, to establish communication we need some type of information. This information originates from the information source.*

*The information generated by the source may be in the form of sound (human speech), picture (image source), words etc.*

**Transmitter:**

*The transmitter is a device which converts the signal produced by the source into a form that is suitable for transmission over a given channel or medium. Transmitters use a technique called modulation to convert the electrical signal into a form that is suitable for transmission over a given channel or medium.*

*When we send the signal over larger distances, it undergoes various circumstances which makes the signal weak. To send the signals over larger distances, without the effect of any external interferences or noise addition and without getting faded away, it must undergo a process called modulation. Modulation increases the strength of a signal without changing the parameters of the original signal. Thus, the resulting signal overcomes the various effects which make it become weak.*

**Communication Channel:**

*The communication channel is a medium through which the signal travels. Communication channels are divided into two categories:*

- i. Guided Channel
- ii. Unguided Channel

*If the channel does not allow the signal following through the medium to escape out of medium, then it is said to be Guided Medium or channel otherwise it is Unguided Channel or Medium. For example, wired communication systems use guided medium as wire and wireless communications systems use unguided medium as open space.*

**Receiver:**

*The receiver is a device that receives the signal from the channel and converts the signal back to its original form (light and sound) which is understandable by humans at the destination.*

**Destination:**

*The destination is the final stage in the communication system. Generally, humans at some places are considered as the destination. A destination is a place where this information is supposed to be consumed.*

### 3. Explain the concept of Normalization?

Normalization is the process of minimizing redundancy from a relation or set of relations. Redundancy in relation may cause insertion, deletion, and update anomalies. So, it helps to minimize redundancies in relations. Normal forms are used to eliminate or reduce redundancy in database tables.

These are the forms of normalizations:

#### 1. First Normal Form:

If a relation contains composite or multi-valued attributes, it violates the first normal form, or a relation is in first normal form if it does not contain any composite or multi-valued attribute. A relation is in the first normal form if every attribute in that relation is a single valued attribute.

Example 1 – Relation STUDENT in table 1 is not in 1NF because of multi-valued attribute STUD\_PHONE. Its decomposition into 1NF has been shown in table 2.

STUD_NO	STUD_NAME	STUD_PHONE	STUD_STATE	STUD_COUNTRY
1	RAM	9716271721, 9871717178	HARYANA	INDIA
2	RAM	9898297281	PUNJAB	INDIA
3	SURESH		PUNJAB	INDIA

Table 1

Conversion to first normal form

STUD_NO	STUD_NAME	STUD_PHONE	STUD_STATE	STUD_COUNTRY
1	RAM	9716271721	HARYANA	INDIA
1	RAM	9871717178	HARYANA	INDIA
2	RAM	9898297281	PUNJAB	INDIA
3	SURESH		PUNJAB	INDIA

Table 2

#### 2. Second Normal Form:

To be in second normal form, a relation must be in first normal form and relation must not contain any partial dependency. A relation is in 2NF if it has No Partial Dependency, i.e., no non-prime attribute (attributes which are not part of any candidate key) is dependent on any proper subset of any candidate key of the table.

*Partial Dependency* – If the proper subset of candidate key determines non-prime attribute, it is called partial dependency.

Example 1 – Consider table-3 as following below.

<i>STUD_NO</i>	<i>COURSE_NO</i>	<i>COURSE_FEE</i>
1	C1	1000
2	C2	1500
1	C4	2000
4	C3	1000
4	C1	1000
2	C5	2000

Table 1 De-normalized Table

{Note that, there are many courses having the same course fee.}

Here,

*COURSE\_FEE* cannot alone decide the value of *COURSE\_NO* or *STUD\_NO*;

*COURSE\_FEE* together with *STUD\_NO* cannot decide the value of *COURSE\_NO*;

*COURSE\_FEE* together with *COURSE\_NO* cannot decide the value of *STUD\_NO*;

Hence,

*COURSE\_FEE* would be a non-prime attribute, as it does not belong to the one only candidate key {*STUD\_NO*, *COURSE\_NO*};

But *COURSE\_NO* → *COURSE\_FEE*, i.e., *COURSE\_FEE* is dependent on *COURSE\_NO*, which is a proper subset of the candidate key. Non-prime attribute *COURSE\_FEE* is dependent on a proper subset of the candidate key, which is a partial dependency and so this relation is not in 2NF.

To convert the above relation to 2NF,

we need to split the table into two tables such as:

Table 2: *STUD\_NO*, *COURSE\_NO*

Table 3: *COURSE\_NO*, *COURSE\_FEE*

<i>STUD_NO</i>	<i>COURSE_NO</i>
1	C1
2	C2
1	C4
4	C3
4	C1
2	C5

Table 2 Student Courses

<i>COURSE_NO</i>	<i>COURSE_FEE</i>
C1	1000
C2	1500
C3	1000
C4	2000
C5	2000

Table 3 Courses Table

*NOTE: 2NF tries to reduce the redundant data getting stored in memory. For instance, if there are 100 students taking C1 course, we don't need to store its Fee as 1000 for all the 100 records, instead, once we can store it in the second table as the course fee for C1 is 1000.*

*Like similar fashion normalization may have the form like*

- i. 1NF
- ii. 2NF
- iii. 3NF
- iv. 4NF
- v. 5NF

### Advantages of Normalization

- *Normalization helps to minimize data redundancy.*
- *Greater overall database organization.*
- *Data consistency within the database.*
- *Much more flexible database design.*
- *Enforces the concept of relational integrity.*

**Disadvantages of Normalization**

- You cannot start building the database before knowing what the user needs.
- The performance degrades when normalizing the relations to higher normal forms, i.e., 4NF, 5NF.
- It is very time-consuming and difficult to normalize relations to a higher degree.
- Careless decomposition may lead to a bad database design, leading to serious problems.

**4. What is the difference between Central and Distributed Database?**

*Difference between Centralized database and Distributed database:*

S.N	Basis of Comparison	Centralized database	Distributed database
1	Definition	<i>It is a database that is stored, located as well as maintained at a single location only.</i>	<i>It is a database that consists of multiple databases which are inter-connected with each other and are spread across different physical locations.</i>
2	Access time	<i>The data access time in the case of multiple users is more in a centralized database.</i>	<i>The data access time in the case of multiple users is less in a distributed database.</i>
3	Management of data	<i>The management, modification, and backup of this database are easier as the entire data is present at the same location.</i>	<i>The management, modification, and backup of this database are very difficult as it is spread across different physical locations.</i>
4	View	<i>This database provides a uniform and complete view to the user.</i>	<i>Since it is spread across different locations thus it is difficult to provide a uniform view to the user.</i>
5	Data Consistency	<i>This database has more data consistency in comparison to distributed database.</i>	<i>This database may have some data replications thus data consistency is less.</i>
6	Failure	<i>The users cannot access the database in case of database failure occurs.</i>	<i>In a distributed database, if one database fails users have access to other databases.</i>

7	<i>Cost</i>	<i>A centralized database is less costly.</i>	<i>This database is very expensive.</i>
8	<i>Maintenance</i>	<i>Ease of maintenance because the whole of the data and information is available at a single location and thus, easy to reach and access.</i>	<i>It is difficult to maintain because of the distribution of data and information at varied places. So, there is a need to check for data redundancy issues and how to maintain data consistency.</i>
9	<i>Efficient</i>	<i>A centralized database is less efficient as data finding becomes quite complex because of the storing of data and information at a particular place.</i>	<i>A distributed database is more efficient than a centralized database because of the splitting up of data at several places which makes data finding simple and less time-consuming.</i>
10	<i>Response Speed</i>	<i>The response speed is more in comparison to a distributed database.</i>	<i>The response speed is less in comparison to a centralized database.</i>
11	<i>Advantages</i>	<ul style="list-style-type: none"> <li>• <i>Integrity of data</i></li> <li>• <i>Security</i></li> <li>• <i>Easy access to all information</i></li> <li>• <i>Data is easily portable</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>High performance because of the division of workload.</i></li> <li>• <i>High availability because of the readiness of available nodes to do work.</i></li> <li>• <i>Independent nodes and better control over resources</i></li> </ul>
12	<i>Disadvantages</i>	<ul style="list-style-type: none"> <li>• <i>Data searching takes time</i></li> <li>• <i>In case of failure of a centralized server, the whole database will be lost.</i></li> <li>• <i>If multiple users try to access the data at the same time, then it may create issues.</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>It is quite large and complex so difficult to use and maintain.</i></li> <li>• <i>Difficult to provide security</i></li> <li>• <i>Issue of data integrity</i></li> <li>• <i>Increase in storage and infrastructure requirements</i></li> <li>• <i>Handling failures is a quite difficult task</i></li> </ul>
13	<i>Examples</i>	<i>A desktop or server CPU, A mainframe Computer etc.</i>	<i>Apache Ignite, Apache HBase etc.</i>



**Group – B (9x5=45)**

**1. What are the advantages of using DBMS?**

*A DBMS manages data and has many benefits. These are:*

- *Data independence: Application programs should be as free or independent as possible from details of data representation and storage. DBMS can supply an abstract view of the data for insulating application code from such facts.*
- *Efficient data access: DBMS utilizes a mixture of sophisticated concepts and techniques for storing and retrieving data competently. This feature becomes important in cases where the data is stored on external storage devices.*
- *Data integrity and security: If data is accessed through the DBMS, the DBMS can enforce integrity constraints on the data.*
- *Data administration: When several users share the data, integrating the administration of data can offer significant improvements. Experienced professionals understand the nature of the data being managed and can be responsible for organizing the data representation to reduce redundancy and make the data retrieve efficiently.*
- *Better decision making: Due to DBMS, we now have improved and managed data access because of which we can generate better quality information which can hence make better decisions. Better quality ultimately improves validity, accuracy, and time it takes to read data. It doesn't guarantee data quality; it provides a framework to make it easy to enhance data quality.*
- *Recovery and Backup: DBMS automatically takes care of recovery and backup. The users are not required to take periodical backup as this is taken care of by DBMS. Besides, it also restores a database after a system failure or crash to prevent its previous condition.*
- *Increased end-user productivity: The available data transforms into helpful information with the help of combination tools. It helps end users make better, informative, and quicker decisions that can make the difference between success and failure in the global economy.*

**2. What do you mean by simplex and duplex mode?**

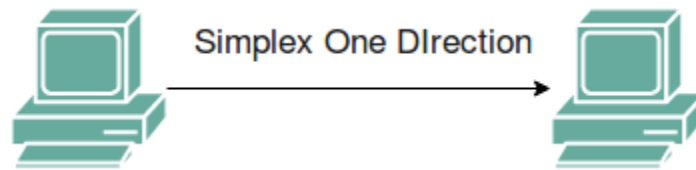
*Transmission mode means transferring data between two devices. It is also known as a communication mode. Buses and networks are designed to allow*

communication to occur between individual devices that are interconnected. There are three types of transmission mode: -

1. *Simplex Mode –*

*In Simplex mode, the communication is unidirectional, as on a one-way street. Only one of the two devices on a link can transmit, the other can only receive. The simplex mode can use the entire capacity of the channel to send data in one direction.*

*Example: Keyboard and traditional monitors. The keyboard can only introduce input, the monitor can only give the output.*

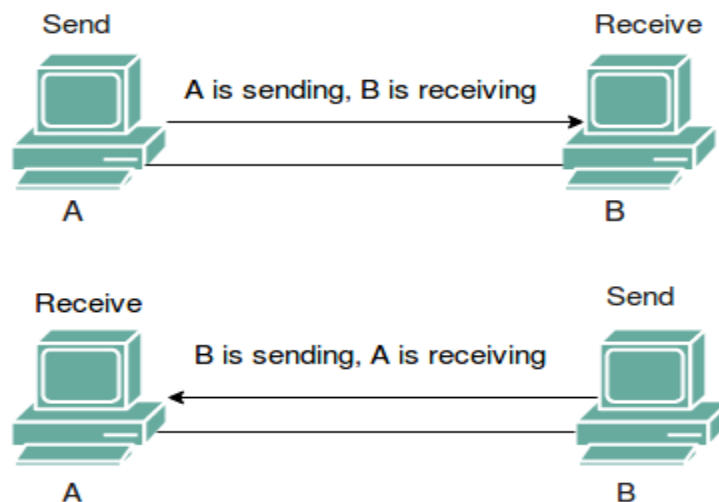


2. *Half-Duplex Mode –*

*In half-duplex mode, each station can both transmit and receive, but not at the same time. While one device is sending, the other can only receive, and vice versa. The half-duplex mode is used in cases where there is no need for communication in both directions at the same time. The entire capacity of the channel can be utilized for each direction.*

*Example: Walkie-talkie in which message is sent one at a time and messages are sent in both directions.*

*Channel capacity=Bandwidth \* Propagation Delay*



### 3. Full-Duplex Mode –

*In full-duplex mode, both stations can transmit and receive mail simultaneously. In full-duplex mode, signals going in one direction share the capacity of the link with signals going in another direction, this sharing can occur in two ways:*

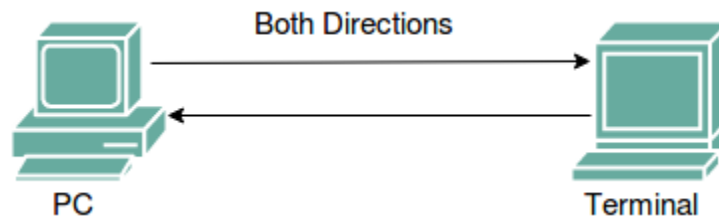
*Either the link must contain two physically separate transmission paths, one for sending and the other for receiving.*

*Or the capacity is divided between signals traveling in both directions.*

*A full-duplex mode is used when communication in both directions is required all the time. The capacity of the channel, however, must be divided between the two directions.*

*Example: Telephone Network in which there is communication between two people by a telephone line, through which both can talk and listen at the same time.*

*Channel Capacity = 2 \* Bandwidth \* propagation Delay*



### 3. What are the models of DBMS? Explain?

*There are many kinds of data models. Some of the most common ones include:*

- *Hierarchical database model*
- *Relational model*
- *Network model*
- *Object-oriented database model*
- *Entity-relationship model*
- *Document model*
- *Entity-attribute-value model*
- *Star schema*
- *The object-relational model, which combines the two that make up its name*

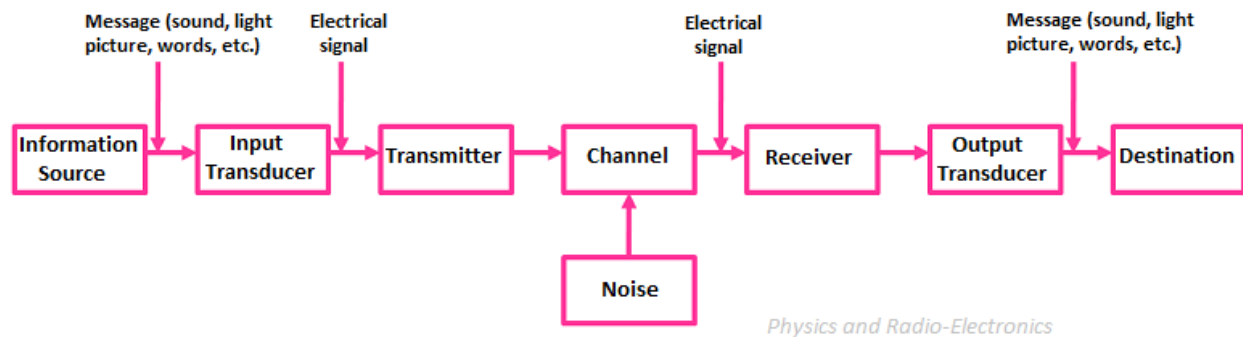
You may choose to describe a database with any one of these depending on several factors. The biggest factor is whether the database management system you are using supports a particular model. Most database management systems are built with a particular data model in mind and require their users to adopt that model, although some do support multiple models.

In addition, different models apply to different stages of the database design process. High-level conceptual data models are best for mapping out relationships between data in ways that people perceive that data. Record-based logical models, on the other hand, more closely reflect ways that the data is stored on the server.

Selecting a data model is also a matter of aligning your priorities for the database with the strengths of a particular model, whether those priorities include speed, cost reduction, usability, or something else.

#### 4. Draw the block diagram of Communication System.

Basic Block diagram of Communication System are shown below:



#### 5. What is IP address and MAC address?

Both IP address and MAC address assist in defining a device uniquely on the computer networks. The manufacturer of the NIC Card provides a user with the MAC address while the ISP (Internet Service Provider) comes up with the IP address. There is a major difference between MAC Address and IP Address. The IP address of a device mainly helps in identifying the connection of a network (using which the device is connecting to the network). The MAC Address, on the other hand, ensures the computer device's physical location. It helps us to identify a given device on the available network uniquely.

The term MAC address is an acronym for Media Access Control Address. The MAC Address refers to a unique identifier that gets assigned to a Network Interface Card/

Controller (NIC). It has a 64-bit, or 48-bit address linked and connected to the concerned network adapter. The MAC Address can exist in a hexadecimal format. This type of address exists in six separate sets of two characters/ digits – separated from each other using colons.

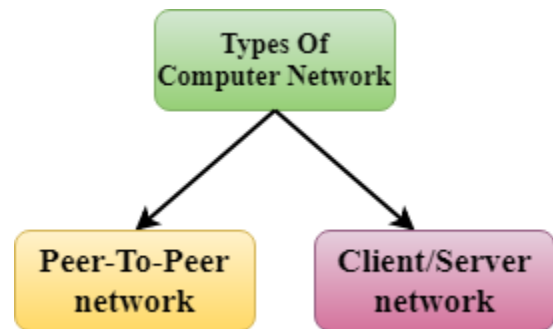
The term IP Address is an acronym for Internet Protocol Address. An IP Address refers to the address that assists a user in identifying a network connection. It also goes by the Logical Address name provided to individual connections in the present network. An IP address lets us understand and control the way in which various devices communicate on the Internet. It also defines the specific behavior of various Internet routers.

## 6. What do you mean by network architecture?

Network architecture refers to the way network devices and nodes are structured or interconnected to serve the connectivity needs or accomplish the goal. Computer Network Architecture is defined as the physical and logical design of the software, hardware, protocols, and media of the transmission of data. Simply we can say that how computers are organized and how tasks are allocated to the computer.

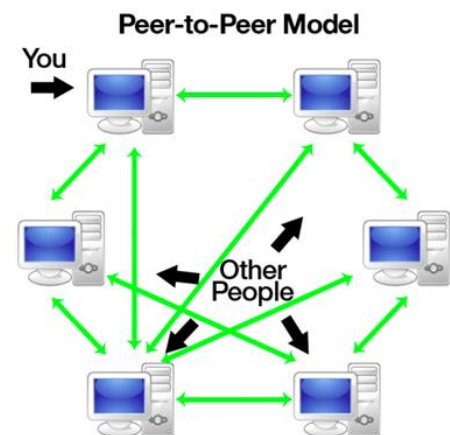
The two types of network architectures are used:

- Peer-To-Peer network (P2P)
- Client/Server network



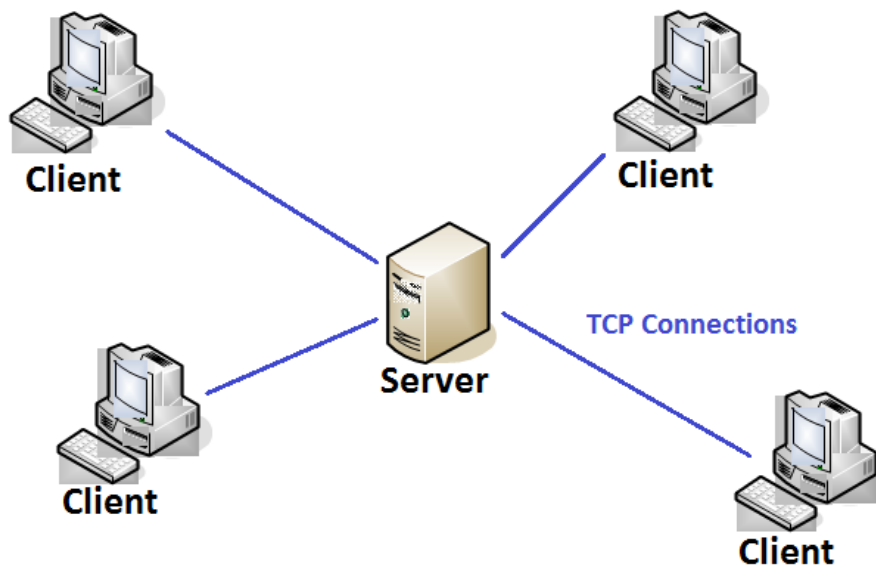
### Peer-to-Peer Architecture

In a peer-to-peer network are allocated to every device on the network. Furthermore, there is no real hierarchy in this network, all computers are considered equal, and all have the same abilities to use the resources available on this network. Instead of having a central server which would act as the shared drive, each computer that's connected to this network would act as the server for the files stored on it.



**Client-server architecture:**

*Client-server architecture, architecture of a computer network in which many clients (remote processors) request and receive service from a centralized server (host computer). In a client/server network, a centralized, powerful computer(server) act as a hub in which other computers or workstations(clients) can connect to. This server is the heart of the system, which manages and provides resources to any client that requests them.*

**7. What do you mean by the dual-core CPU?**

*A single chip that contains two distinct processors which work simultaneously resulting double in performance. IBM introduced dual cores in its Power 4 chips in 2000. In 2004, Sun and HP introduced their first dual core CPUs. Dual core means that two processors are embedded into one integrated circuit, so their caches and caches controllers are combined into single chip. Both processors are linked with each other, and due to this linkage, dual core can execute their operations twice as fast compared to single core processor. Dual core processors are more useful for multitasking environment because both processors perform their operations independently. It can execute 64-bit instructions as well as hyper threading supportive. Dual core processors have excellent performance compared to single core processors. It is capable of split their data for processing by several units. Dual core processor must move between different types of threads compared to single core processor because single core processor can manage two threads at once. But some*

time, single core can perform outstanding to dual core when CPU's clock speed is getting higher that is measured into GHz.

**8. What is the full form of DBMS, DDL, DML, LAN and WAN?**

*Full forms of asked terms can be written as below:*

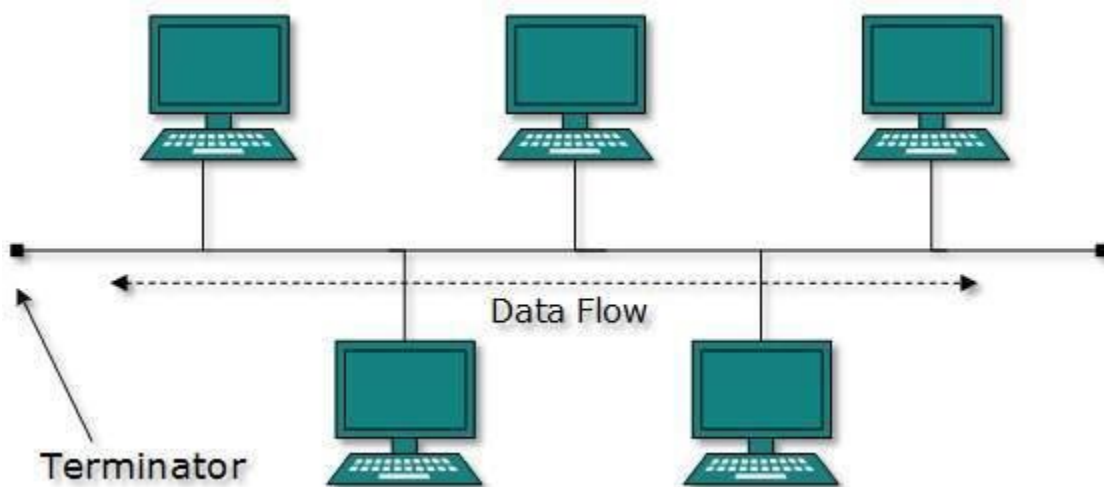
1. DBMS: Database Management System
2. DDL: Data Definition Language
3. DML: Data Manipulation Language
4. LAN: Local Area Network
5. WAN: Wide Area Network

**9. Write short notes on various network topologies.**

*A Network Topology is the arrangement with which computer systems or network devices are connected to each other. Topologies may define both physical and logical aspect of the network. Both logical and physical topologies could be the same or different in a same network.*

**Bus Topology**

*In case of Bus topology, all devices share single communication line or cable. Bus topology may have problem while multiple hosts sending data at the same time. Therefore, Bus topology either uses CSMA/CD technology or recognizes one host as Bus Master to solve the issue. It is one of the simple forms of networking where a failure of a device does not affect the other devices. But failure of the shared communication line can make all other devices stop functioning.*



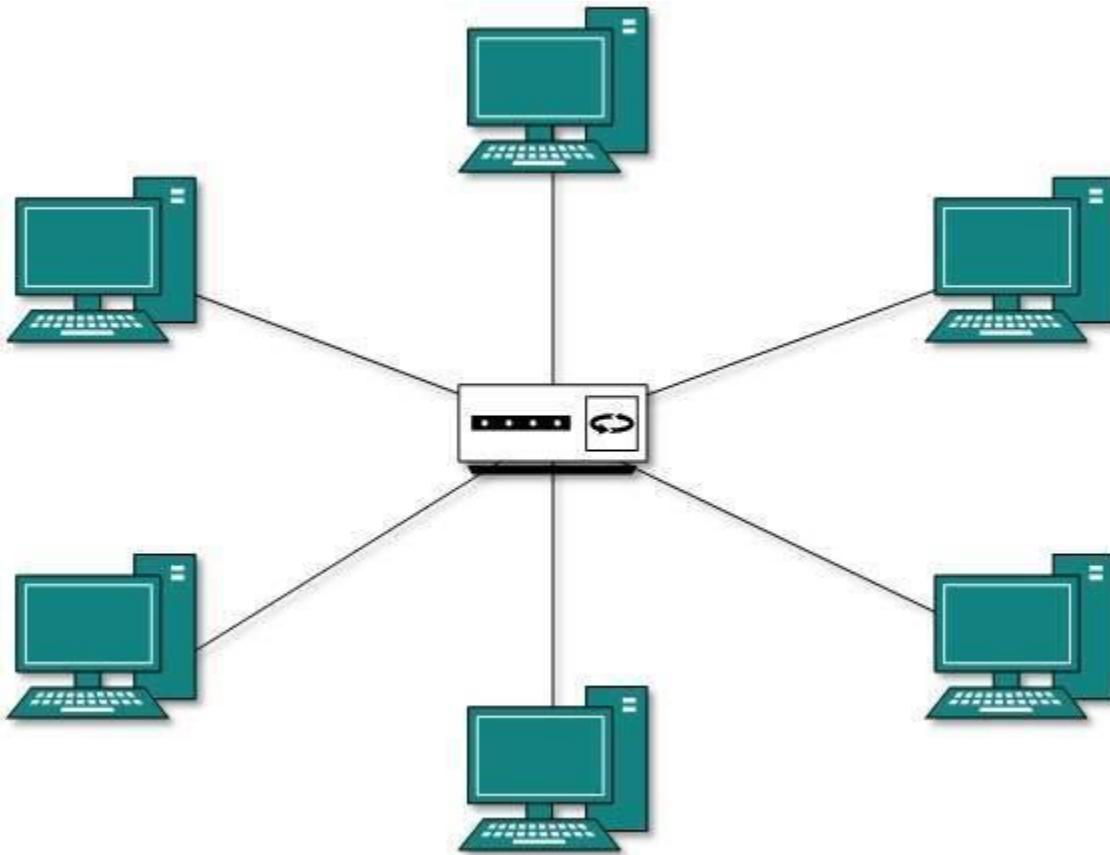


*Both ends of the shared channel have line terminator. The data is sent in only one direction and as soon as it reaches the extreme end, the terminator removes the data from the line.*

### **Star Topology**

*All hosts in Star topology are connected to a central device, known as hub device, using a point-to-point connection. That is, there exists a point-to-point connection between hosts and hub. The hub device can be any of the following:*

- *Layer-1 device such as hub or repeater*
- *Layer-2 device such as switch or bridge*
- *Layer-3 device such as router or gateway*

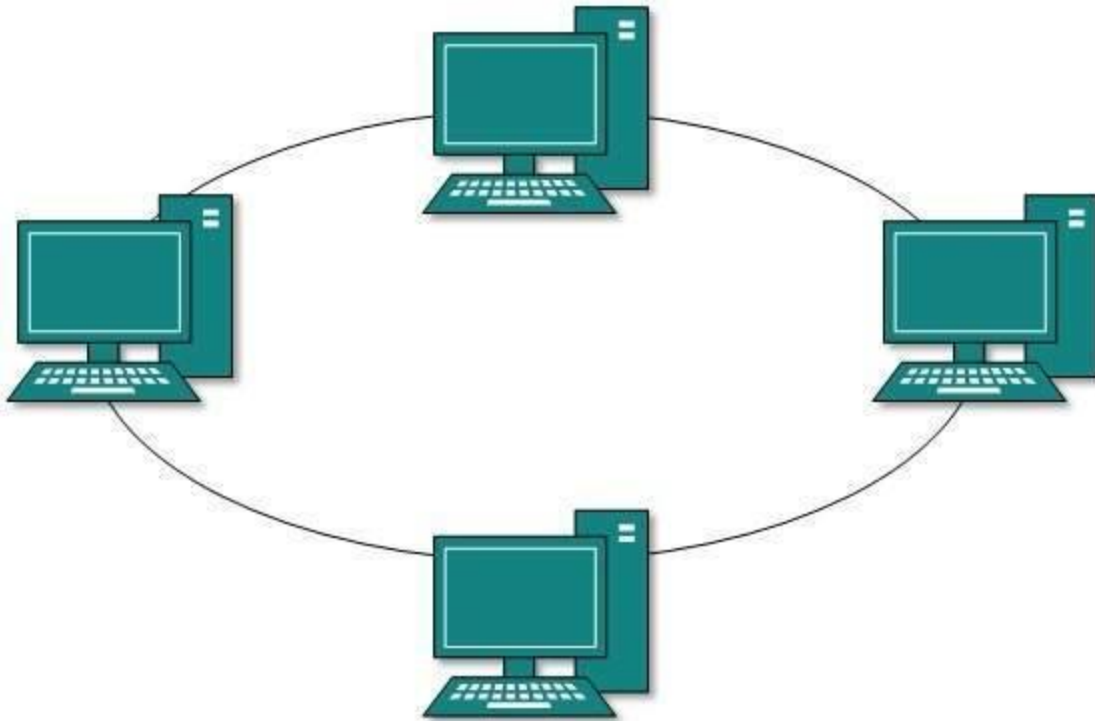


*As in Bus topology, hub acts as single point of failure. If hub fails, connectivity of all hosts to all other hosts fails. Every communication between hosts, takes place through only the hub. Star topology is not expensive as to connect one more host, only one cable is required, and configuration is simple.*



### **Ring Topology**

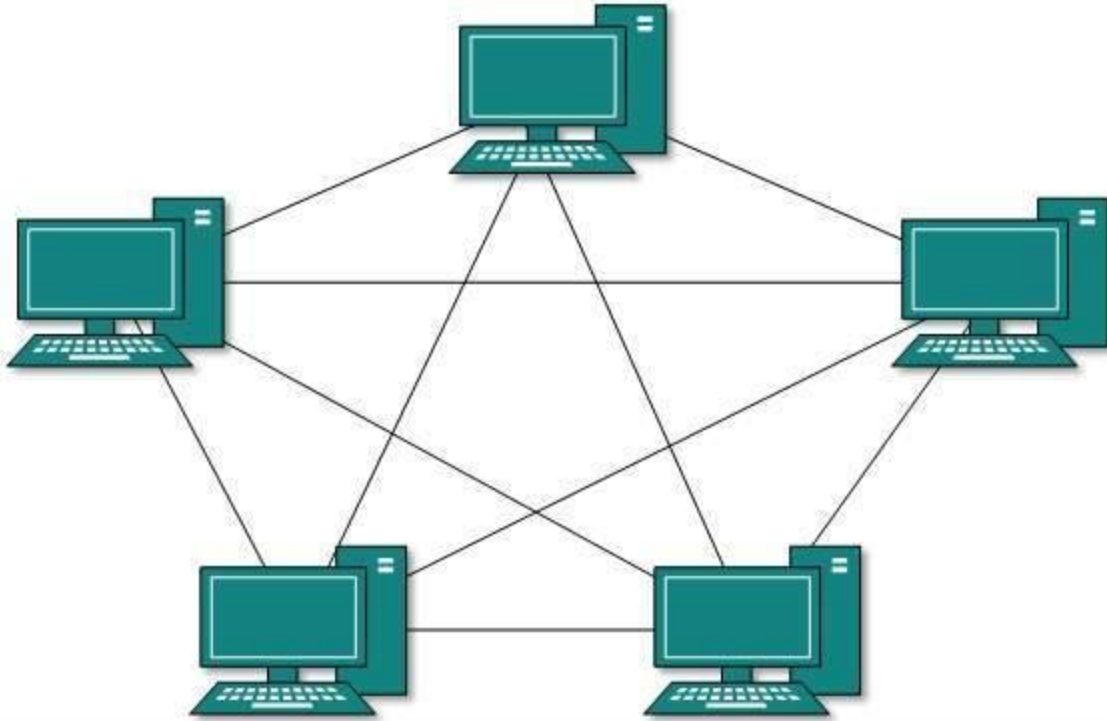
*In ring topology, each host machine connects to exactly two other machines, creating a circular network structure. When one host tries to communicate or send message to a host which is not adjacent to it, the data travels through all intermediate hosts. To connect one more host in the existing structure, the administrator may need only one more extra cable.*



*Failure of any host results in failure of the whole ring. Thus, every connection in the ring is a point of failure. There are methods which employ one more backup ring.*

### **Mesh Topology**

*In this type of topology, a host is connected to one or multiple hosts. This topology has hosts in point-to-point connection with every other host or may also have hosts which are in point-to-point connection to few hosts only.*



*Hosts in Mesh topology also work as relay for other hosts which do not have direct point-to-point links. Mesh technology comes into two types:*

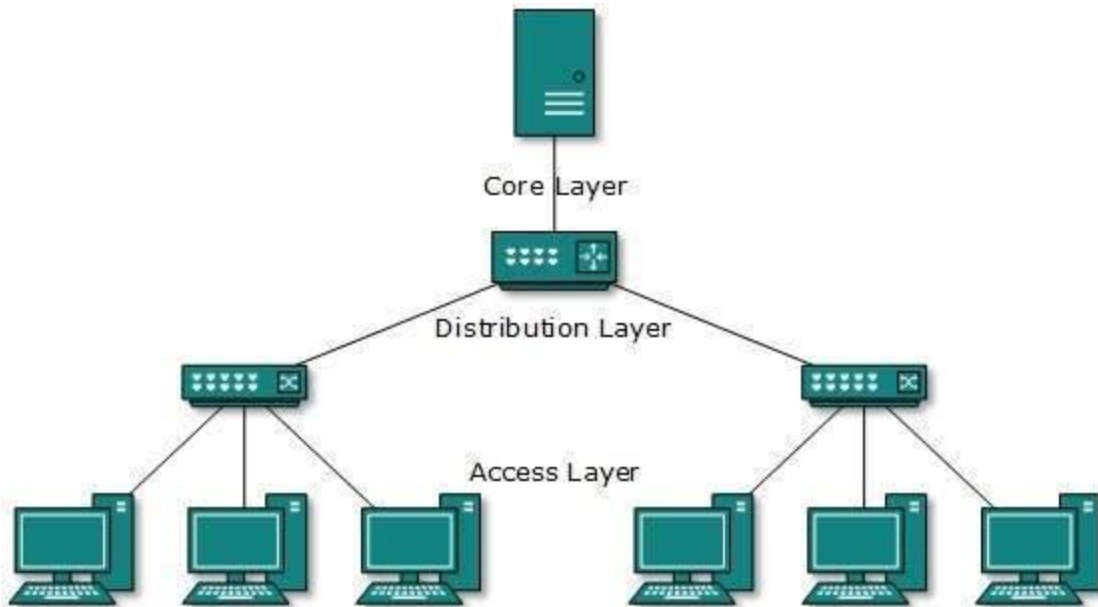
- **Full Mesh:** *All hosts have a point-to-point connection to every other host in the network. Thus, for every new host  $n(n-1)/2$  connections are required. It provides the most reliable network structure among all network topologies.*
- **Partially Mesh:** *Not all hosts have point-to-point connection to every other host. Hosts connect to each other in some arbitrarily fashion. This topology exists where we need to provide reliability to some hosts out of all.*

### **Tree Topology**

*Also known as Hierarchical Topology, this is the most common form of network topology in use presently. This topology imitates as extended Star topology and inherits properties of bus topology.*

*This topology divides the network into multiple levels/layers of network. Mainly in LANs, a network is bifurcated into three types of network devices. The lowermost is access-layer where computers are attached. The middle layer is known as distribution layer, which works as mediator between upper layer and lower layer.*

The highest layer is known as core layer, and is central point of the network, i.e., root of the tree from which all nodes' forks.



All neighboring hosts have point-to-point connection between them. Like the Bus topology, if the root goes down, then the entire network suffers even. Though it is not the single point of failure. Every connection serves as point of failure, failing of which divides the network into unreachable segment.

### Daisy Chain

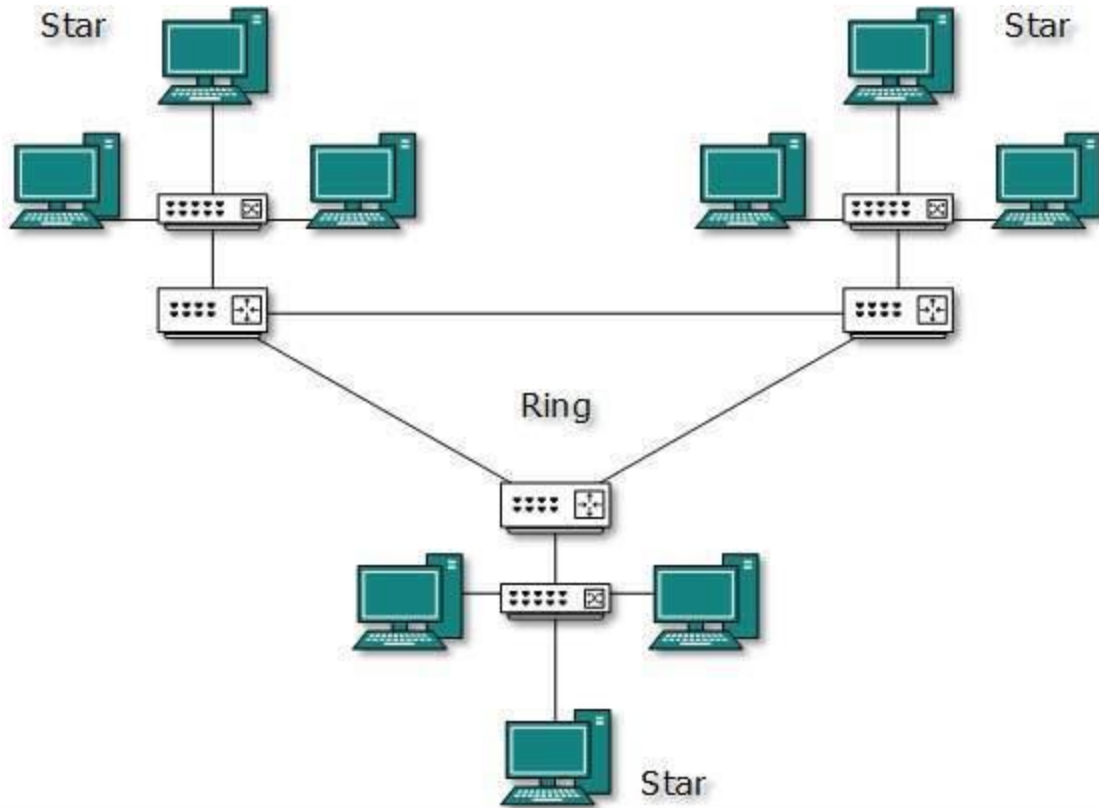
This topology connects all the hosts in a linear fashion. Like Ring topology, all hosts are connected to two hosts only, except the end hosts. Means, if the end hosts in daisy chain are connected then it represents Ring topology.



Each link in daisy chain topology represents single point of failure. Every link failure splits the network into two segments. Every intermediate host works as relay for its immediate hosts.

### Hybrid Topology

*A network structure whose design contains more than one topology is said to be hybrid topology. Hybrid topology inherits merits and demerits of all the incorporating topologies.*



*The above picture represents an arbitrarily hybrid topology. The combining topologies may contain attributes of Star, Ring, Bus, and Daisy-chain topologies. Most WANs are connected by means of Dual-Ring topology and networks connected to them are mostly Star topology networks. Internet is the best example of largest Hybrid topology.*

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