

CT 8 01

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### Question 1

a) Define communication. What is telecommunication?

Answer: The exchange of information between two or many individuals is called communication. The word 'tele' is a Greek word which means distance. Hence, telecommunication means the exchange of information between two distant places.

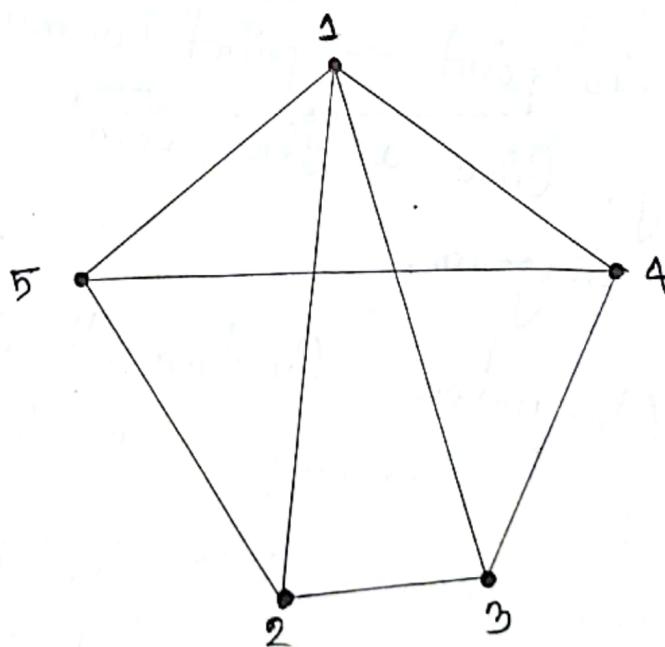
b) What is point-to-point communication? Describe briefly. Give a five point-to-point communication diagram.

Answer: Alexander Graham Bell demonstrated the point-to-point communication, in which a calling subscriber chooses the appropriate link to establish connection with the called subscriber. This

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system also requires some mode of signalling to alert the called subscriber about the incoming call and a signal to indicate the calling subscriber, when the called subscriber is busy on another call.

Here, is an example for five subscribers of point-to-point communication :-



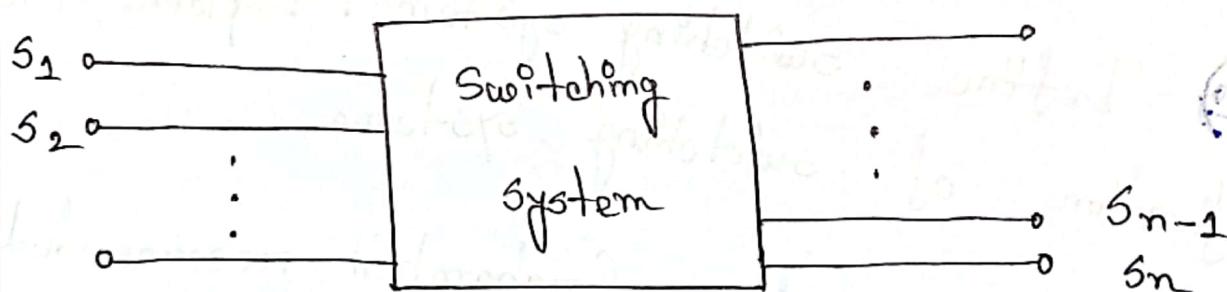
In the point-to-point connection, for  $n$  entities, we need  $n(n-1)/2$  links. All these links form a network. Networks with point-to-point links among all the entities are known as fully connected networks. The number of links required in a fully connected network becomes very large even with the moderate values of  $n$ .

Q) Define switching systems. Explain the classification of switching systems.

Answer: Alexander Graham Bell recommended the switching between the subscribers using a switching office that maintains the telephone networks. This network connection cannot be simply made with telephone sets and

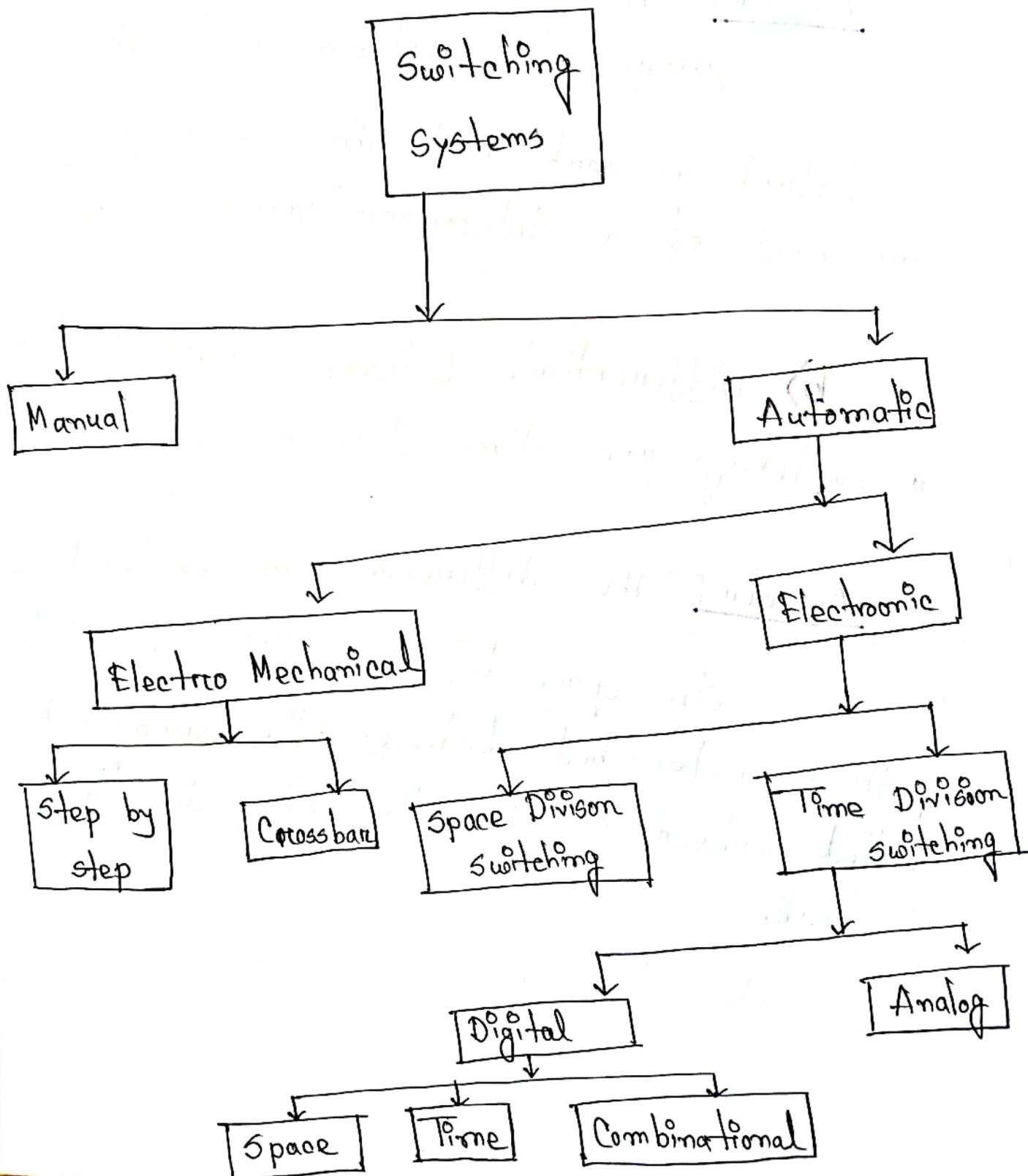
bunch of wires, but a good system is required to make or break a connection.

This system is known as the switching system or the switching office or the exchange. An example for switching system is —



In the early stages of telecommunication systems, the process and stages of switching played an important role to make or break connections. The following flowchart

shows how the switching systems are classified :-



## Question 2

a) Define telecommunication network.

Answer: A telecommunication network is a group of systems that establishes a distant network call. The switching systems are part of a telecommunication network.

b) Differentiate between space division switching and time division switching.

Answer: The differences are explained below.

In space division switching, a dedicated path is established between the calling and called subscribers for the entire duration of the call.

In time division switching, sampled

values of speech signals are transferred to at fixed intervals. The time division switching may be analog or digital. In analog switching the sampled voltage levels are transmitted as they are. In binary switching, they are binary coded and transmitted.

c) classify the connections type in

telecommunication network.

Answer: There are four types of connection that can be established in a telecommunication network. The connections are as follows.

1) Local call connection between two subscribers in the system.

2) Outgoing call connection between a subscriber and an outgoing trunk.

3) Incoming call connection between an incoming trunk and an local subscriber.

4) Transit call connection between an incoming trunk and an outgoing trunk.

d) What are the elements of switching system?

Answer: Though there are different kinds of switching systems from around manual to automatic, a few elements play an essential role for the functioning of a switching system. Along with the switching network, there are different sub-systems such as control sub-system, signalling system, trunk and subscriber line interfaces.

distributor units, operators console, puncture circuits, essential for the operation of the whole switching system.

e) What are the advantages of Automatic switching system?

Answer The automatic switching systems come with the following advantages:-

- 1) Language barriers will not affect the request for connection.
- 2) Higher degree of privacy is maintained.
- 3) Faster establishment and release of calls is done.
- 4) Number of calls made in a given period can be increased.
- 5) Calls can be made irrespective of the load on the system or the time of day.

### Question 3

a) Explain direct and indirect control switching systems.

Answer: The switching systems are of the following two types:-

1) The direct control switching system: The switching systems where the control sub-systems form an integral part of the network are called the direct control switching systems. For example, the store-and-forward switching systems.

2) Indirect control switching system: The switching system in which the control sub-system is present outside the switching network is called the indirect control system. The examples of this system include Crossbar switching system, Electronic switching system etc.

Stored program control method of switching systems.

b) What signalling functions that are to be performed by the operators?

Answer: The signalling functions that are to be performed by the operators are given below:-

- 1] Respond to the calling subscriber that system is ready to receive the identification of the called party.
- 2] Inform the calling subscriber that the call is being established.
- 3] Ring the bell of the called party.
- 4] Inform the calling subscriber, if the called party line is unobtainable for some reason.
- 5] Inform the calling subscriber, if the called

c) Explain the signaling tones.

Answer: The signaling tones are explained below:-

1) Dial tone: The dial tone is the signaling tone, which indicates that the exchange is ready to accept the dialed digits from the subscriber. The number should be dialed only when this signal is heard. Otherwise, the digits dialed before this signal will not be considered. This will lead to the dialing of a wrong number.

2) Ring tone: After dialing the number of the called party, when the line of the called party is obtained, the exchange control equipment sends out the ringing current to the telephone set of the called party, which

is a familiar double-ringing pattern.

Simultaneously, the control equipment sends out a ringing tone to the calling subscriber, which has a pattern similar to that of the ringing current.

3) Busy tone: After dialing the required

number, if the called subscriber on the lines at the exchange are not free to place a call, the calling subscriber is sent a busy tone indicating the lines or the subscriber is busy, this is called a busy tone.

4) Number unobtainable tone: If the called

party is out of order or disconnected or if an error in dialing leads to the selection of a spare line, such a situation is indicated using a continuous 400Hz signal, called as number unobtainable tone.

## 5) Routing tone or call-in-progress tone:

When a subscriber call is routed through a number of different types of exchanges, one hears different call-in-progress tones as the call progresses through different exchanges.

d) classify switching mechanisms.

Answer: There are of two types of switching mechanisms —

1) Uni selector switching

2) Two-motion selector switching.

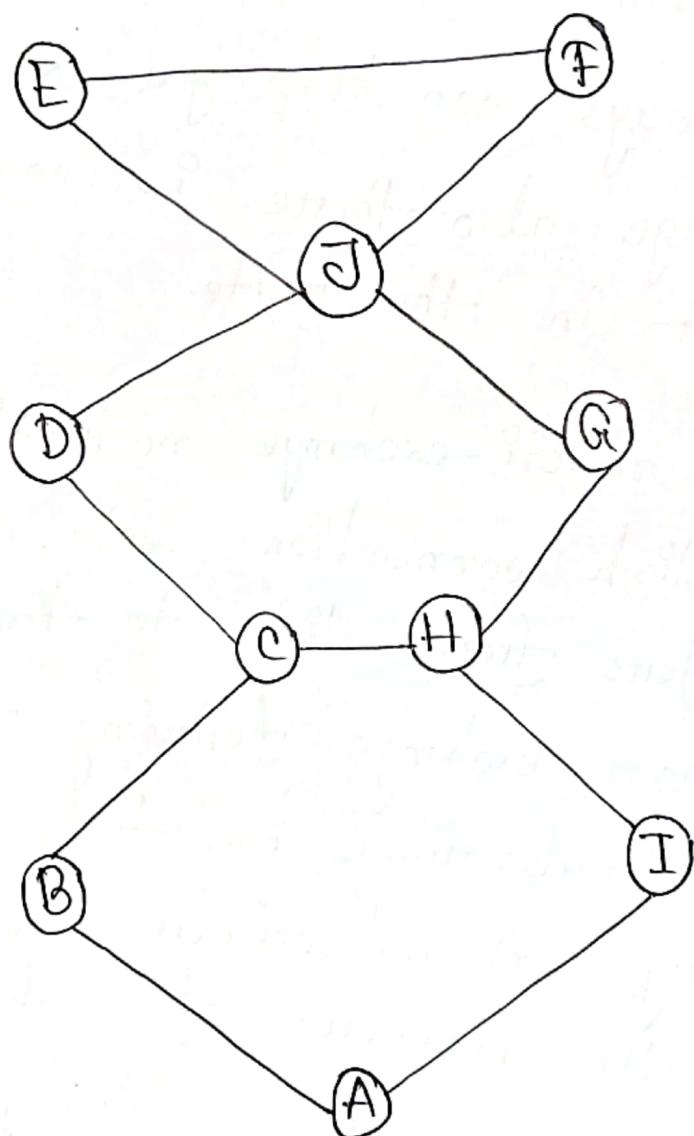
### Question 4

a) Explain the Multi-Exchange network.

Answer: When a subscriber belonging to a particular network has to be contacted, a number of ways can help you contact the particular exchange; also there is not one but any exchanges present in the route.

In a multi-exchange network, the routes used to establish connection with a particular subscriber differs from time to time. In the following stronger exchange following the Multi-exchange network, the subscriber has to be more concerned with the routing. A subscriber should have the details of all the numbers of exchanges present in the route. There may arise situations where a subscriber may be required to establish a connection on other routes; this becomes cumbersome at times.

The following figure is an example of the topology of a Multi-exchange network.



b) Write down the disadvantages of implementing Multi-exchange network in switching. What is the solution? How it solves?

Answer: The disadvantages of Multi-exchange network in switching is given below:-

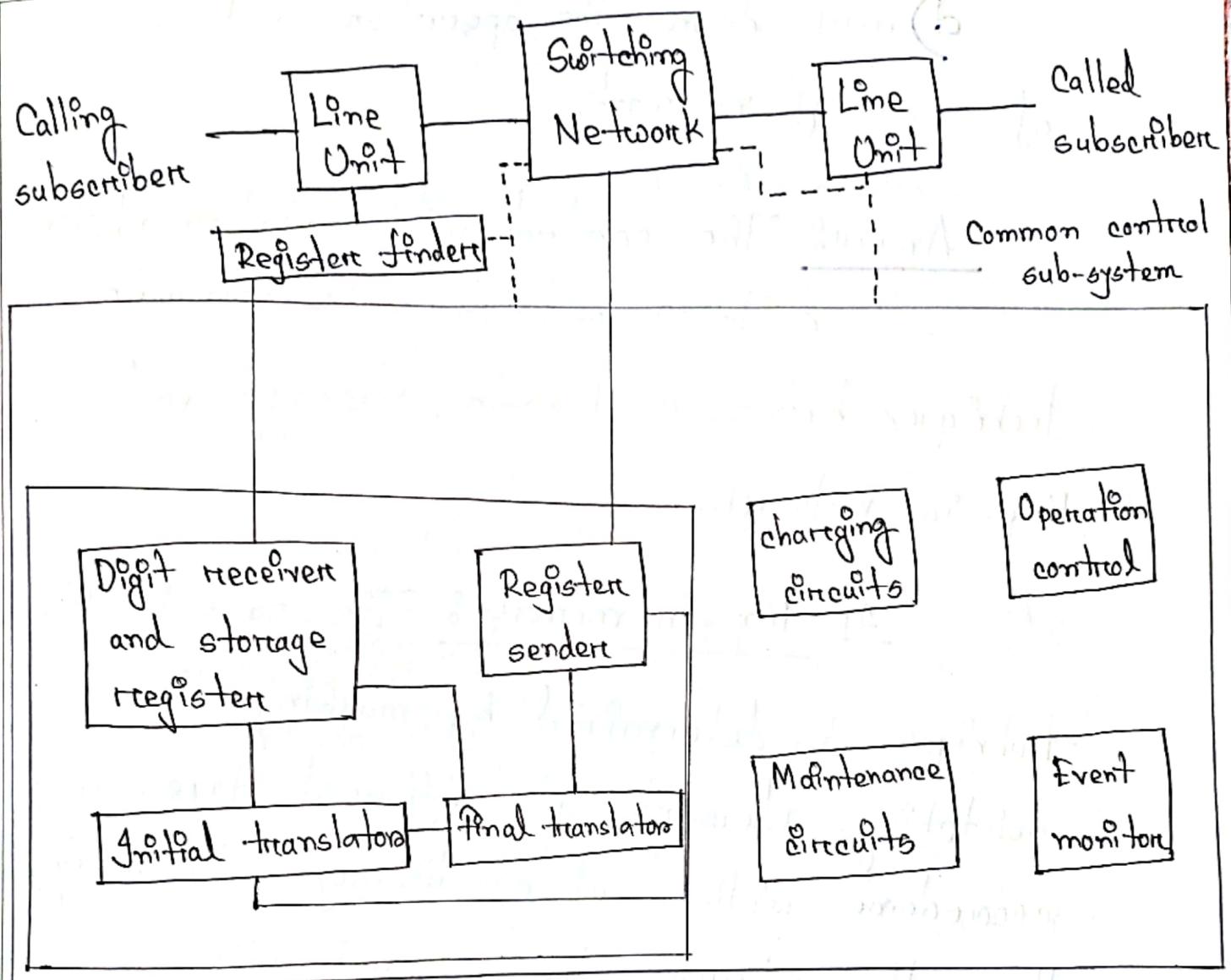
- 1) The subscriber identity number is changed depending on the calling route.
- 2) The user must have knowledge on the topology of the exchanges present on it.
- 3) The number and size of the called subscriber varies depending upon the exchange from where the call originates.

In order to overcome these problems, the common control sub-system is used.

- 1) The routing of the call should be done by the exchange, but not by the numbers dialed.
- 2) A unique identification number should be allotted to the subscriber. The UIN contains the number of the exchange of the subscriber and the number indicating the line of subscriber.

c) Draw the diagram of common control subsystem.

Answer: The following figure shows the diagram of the common control sub-system, which contains call processing sub-system, charging circuits, operation control, maintenance control and event monitors.



— Data or information path

The above block diagram is a simple indication of the common control switching system. The control functions in a switching system can be also shown in the diagram.

d) Write down the operation and maintenance of switching network.

Answer: The control and operation of the switching network with two main techniques known as Map-in-memory and Map-in-network.

1) Map-in-memory: The path in this technique is determined by marking the switching elements at different stages in accordance with a set of binary data defining the path, whereas the control unit supplies the data. At this stage, the command for the actual connection of the path is given. This MIM technique is present in stored program control.

2) Map-in-network: In this technique, the path finding may be carried out at the level of common control unit, where it marks the inlet and outlet to be connected and the actual path is determined by the switching network. This MIN technique is common in Crossbar exchanges using markers for control.

### Question 5

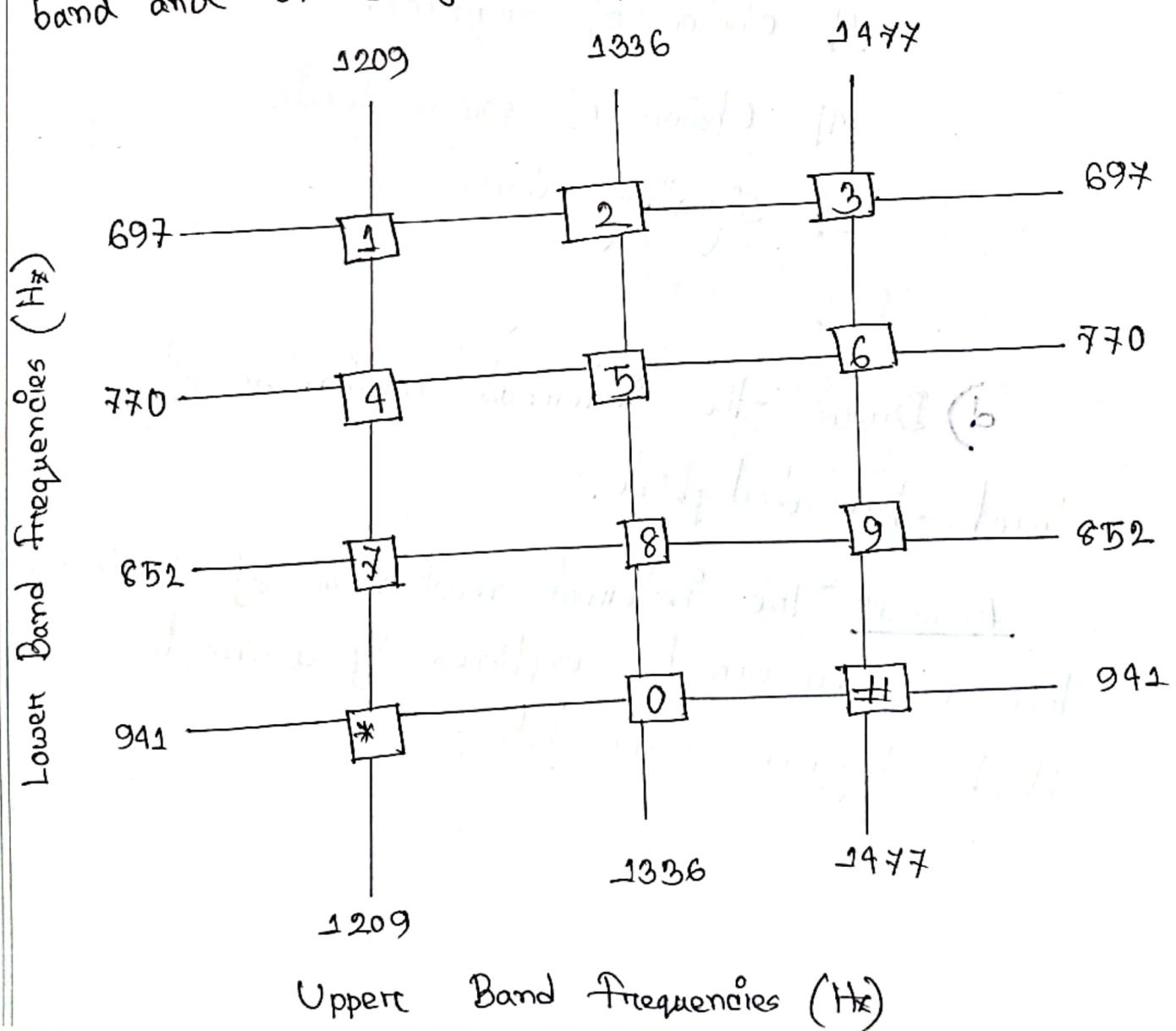
a) What is the need for Touch-tone?

Answer: With the introduction of the common control subsystems into switching exchangers, there came the feasibility for higher rates of dialing. A new system called the touch tone dialing was developed in telephony to replace the rotary dial, this was considered to benefit the customer with higher speed. This has also removed the disadvantages of limited usage and limited signaling capacity along with lower speed.

Hence replacing the inconvenience of using the rotary dial, the touch tone dial telephone was introduced.

b) How does the touch tone dial phone operate?

Answer: The press of a button on the touch tone dial telephone indicates the number dialed using certain frequencies. Touching one digit of a number generates a tone which is a combination of two frequencies, one from lower band and other from upper band.



c) What points are considered while the designing of touch tone dial telephone?

Answer: The design considerations are:-

- 1) Choice of code
- 2) Band separation
- 3) choice of frequencies
- 4) Choice of power levels
- 5) Signalling duration

d) Draw the internal mechanism of touch tone dial phone.

Answer: The internal mechanism of the touch tone receiver can be explained by a simple block diagram given below:-

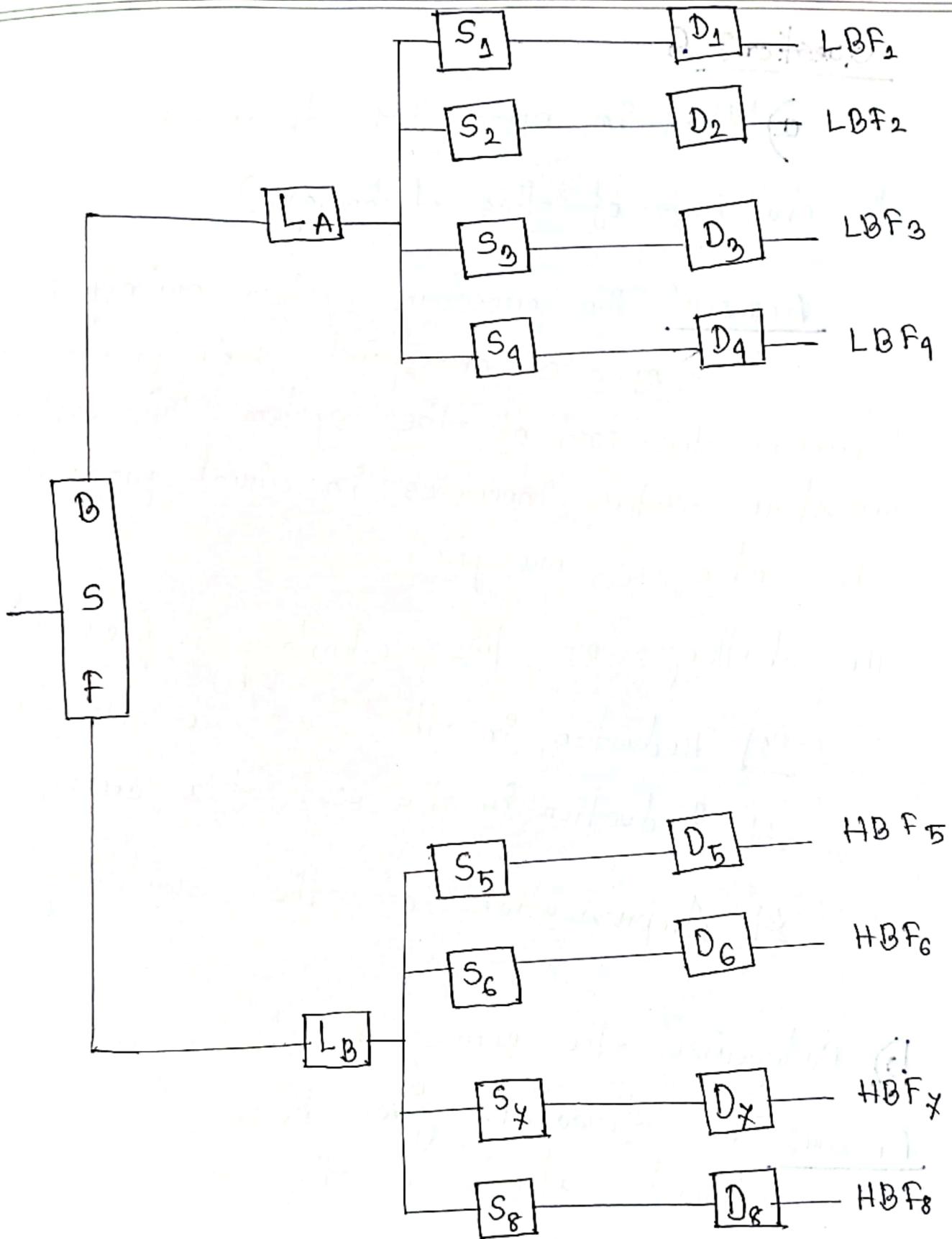


Figure 8: Internal mechanism of TT Dial telephone

## Question 6

a) What is crosspoint technology? What are the challenges of this technology?

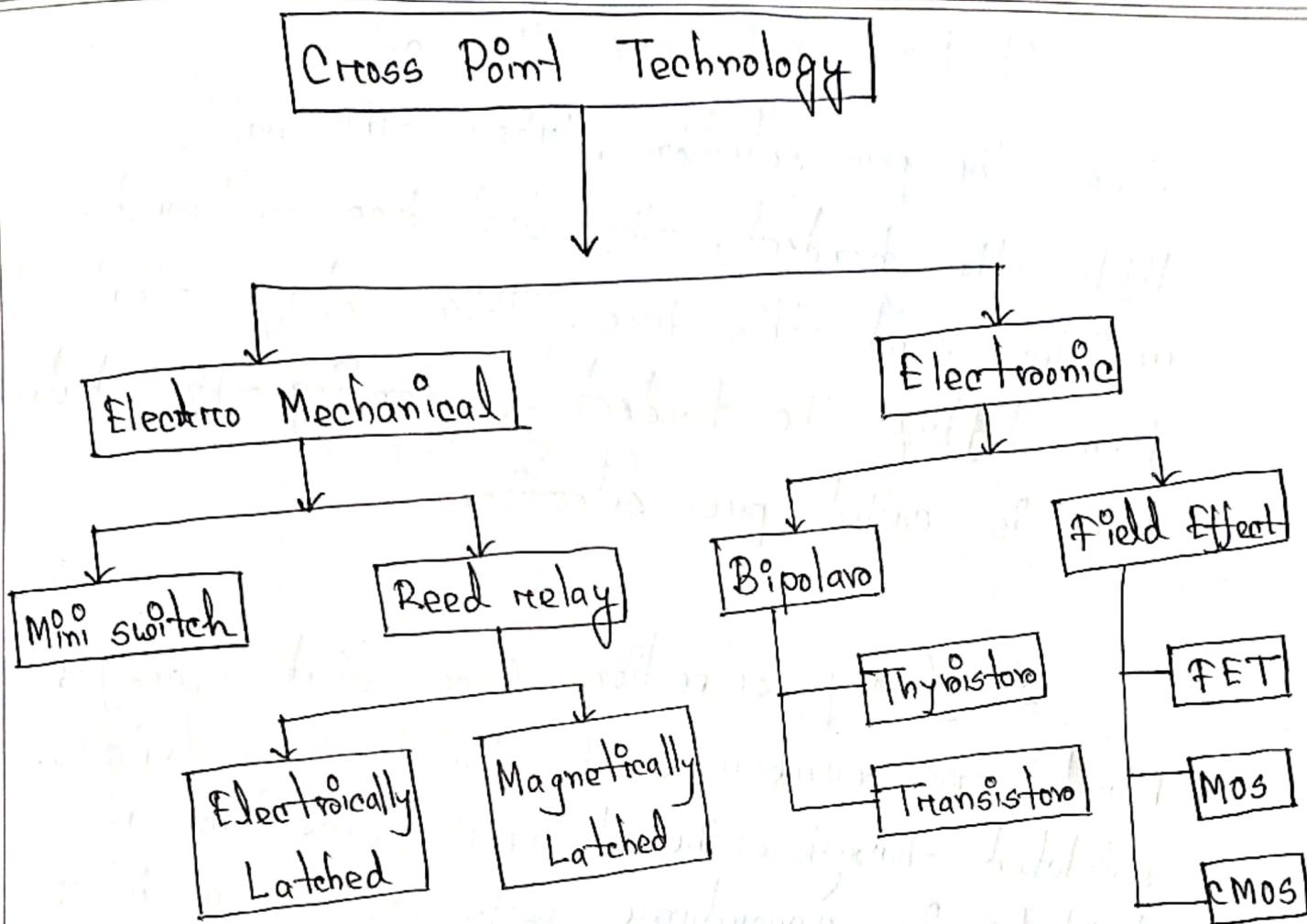
Answer: The crossbar system mainly consists of the crosspoint switches, which increases the cost of the system. The cost of crossbar system increases in direct proportion to the number of crosspoint.

The challenges of this technology is given below:-

- 1) Reduction in the size of a crosspoint
- 2) Reduction in the cost of a crosspoint
- 3) Improvisation of the switching time

b) Categorize the crosspoint technology.

Answer: The flowchart given below shows the different categories of the crosspoint technology.



c) Write down the call processing in Crossbar exchange.

Answer: The call processing in crossbar exchange is done in three stages. They are explained below:-

1) Pre-selection: The originating market does the pre-selection. When the calling subscriber lifts the handset, the dial tone is heard. The register sends this tone. This stage that starts from lifting the handset to sending the dialed tone is called pre-selection.

2) Group selection: Once dial tone is heard, the number can be dialed. The call is switched through the desired direction as decided, in accordance with code given by the translators. This stage of selecting the desired group for making a call is called Group selection.

3) Line selection: Once a number is dialed, the calling subscriber is connected to the called subscriber by the terminating market. The line

of the called party is controlled by the terminating marker which also sets up ringing on the line. This stage of selecting the line of the desired subscriber can be called as line selection.

d) What information does a process control block contains?

Answer: The process control block represents each process in the operating system. PCB is a data structure containing the following information about the following about the process.

1) Current running state of the process.  
2) Process priority which are in the ready state.

3) CPU scheduling parameters  
4) Saves the content of CPU, when a process gets interrupted

5) Memory allocation of the process.

6) The details of process like its number, CPU usage etc. are present

7) Status of events and I/O resources that are associated with process.

Process control block (PCB) has all the information about the processes to be executed next when it gets the CPU.

### Question :-

a) Classify and explain different data networks.

Answer: Data networks are classified according to their geographical coverage:

1) Wide area network (WAN): Intercity, inter country and intercontinental networks are known as WANs. Based on the communication infrastructure used, they may be classified as terrestrial data networks or satellite based data networks.

2) Metropolitan area network (MAN): A

metropolitan area network interconnects computers within a metropolitan city. Community antenna television cables, twisted pair wires are shielded lines, optical fibres, radio links on line-of-sight, optical communication links provide the

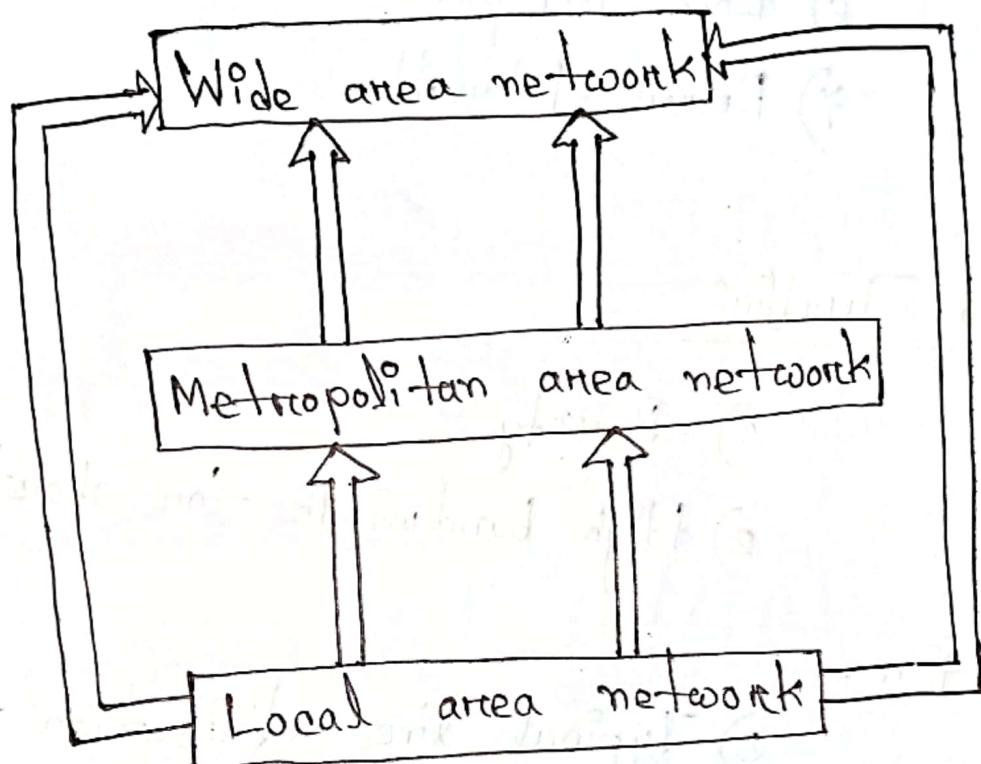
communication medium for MAN. The broadband capability for CATV cables permits carrying voice, data and video simultaneously. The MANs are usually multimedia networks.

3) Local area networks: Local area networks are confined to a single building or a group of buildings generally belonging to the same organisation. Optical fibres, twisted pair and co-axial cables are used as the communication media for LANs. Fibre optic networks are suitable for both LANs and MANs.

6) Draw the data networks hierarchy.

Answer: LANs, MANs and WANs are generally interconnected in a hierarchical

manner to form a global network as shown in the figure below:-



c) Differentiate between voice and data traffic.

Answer :- The differences between voice and data traffic is given below:-

Voice Traffic :-

- 1) Continuous
- 2) Low bandwidth for long duration
- 3) Typical line utilisation 85 - 95%

- 4) Half duplex
- 5) Real time
- 6) Loss acceptable
- 7) Error tolerable

## Data Traffic

- 1) Bursty
- 2) High bandwidth for short duration.
- 3) Typical line utilisation 5-15%
- 4) Half or full duplex
- 5) Non real time or near real time
- 6) Loss unacceptable
- 7) Error unacceptable

d) What is circuit switching? Classify store and forward switching. What functions are performed by the node when a message is transmitted?

Answer: In circuit switching, an electrical path is established between the source and destination before any data transfer takes place. The electrical path may be realised by physical wires or coaxial cables or radio or satellite links. It remains dedicated to the communicating pair for the entire duration of the transmission irrespective of whether data is actually transferred or not.

The store and forward switching may be classified as:-

- 1] Message switching
- 2] Packet switching

In message switching, once the transmission is initiated, a message is transmitted in its entirety without a break from one node to another. The node processor performs the following functions:-

- 1) Receive the full user message and store the same.
- 2) Check the message for data transmission errors and perform error recovery if required.
- 3) Determine the destination address from the user message.
- 4) choose an appropriate link towards destination based on certain routing criterion.

5) forward the message to the next node on the chosen link.

### Question 8

a) Define these keywords : System, Subsystem, Layer, Entity.

Answer: System: A system is one or more autonomous computers and their associated software, peripherals and users, which are capable of information processing and are transferred.

Subsystem: A logically independent smaller unit of a system. A session of subsystem make up a system.

Layer: A layer is composed of subsystems of the same rank of all the interconnected systems. The concept of a layer is illustrated as

a  $n$ -layer network. The subsystems and the layers are numbered starting with one at the bottom level.

Entity: The functions in a layer are performed by a hardware subsystems and are software packages. These are known as entities. ISO - OSI architecture is a layered one. Layering is a common or natural choice for communication architectures.

b) Write down the link-to-link layers. Classify the routing algorithms using a diagram / flowchart.

Answer: The layers are :

1. Physical layer
2. Data Link layer

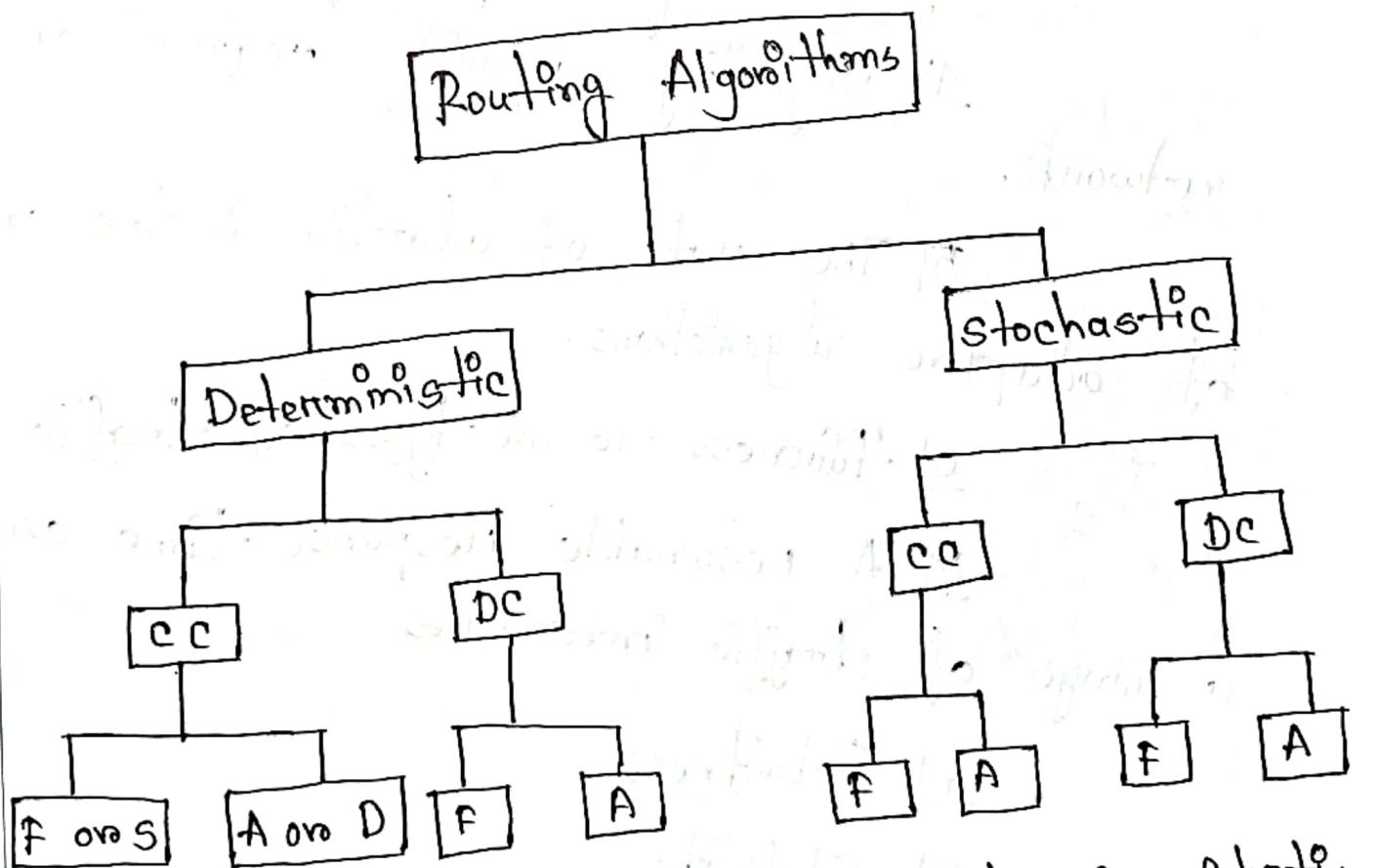
3. Network layers

4. Transport layers

5. Presentation layers

6. Application layers

The flowchart for classifying routing algorithms  
is given below—



cc - Centralised control

DC - Distributed control

F - Fixed

S - Static

A - Adaptive

D - Dynamic

c) What measures used in assessing the performance of a routing algorithm?

Answer: The measures are given below—

- 1] Minimum delay
- 2] Minimum number of intermediate nodes or hops
- 3] Processing complexity
- 4] Signalling capacity required on the network.

5] The rate of adaption in the case of adaptive algorithms.

- 6] Fairness to all types of traffic
- 7] A reasonable response time over a range of traffic intensities
- 8] Robustness
- 9] Stability.

d) Write down the Quality of Service (QoS) parameters.

Answer: The QoS parameters are given below-

- 1] Transit delay
- 2] Residual error rate
- 3] Protection
- 4] Transfer failure probability
- 5] Priority
- 6] Throughput

e) Give some examples of LAN networks.

What are its advantages?

Answer: A local area network (LAN) typifies a distributed environment and finds applications in a number of areas. Some examples are:

- 1] office automation
- 2] factory automation

3. Distributed computing

4. Fire and security systems

5. Process control

6. Document distribution

The advantages offered by LANs

are:-

1) Unlike a large centralised system, a LAN may evolve with time. It may be put into operation with a small investment, and more systems may be added as the need arises.

2) Since LAN is a set of multiple interconnected systems, it offers a good back up capability in the event of one or two systems failing in the network.

3) LAN provides a resource sharing environment. Expensive peripherals, hosts and databases may be shared by all the LAN users.

4) A LAN adhering to a certain standard permits multivendor systems to be connected to it.

5) In LAN, the systems are generally so chosen as to meet most of the user.