

COMPUTER NETWORKS

MODEL QUESTION PAPER WITH SOLUTION

Q-1(a) In *half-duplex transmission*, only one entity can send at a time; in a *full-duplex transmission*, both entities can send at the same time.

(b) The number of cables for each type of network is:

a. *Mesh*: $n(n-1)/2$

b. *Star*: n

c. *Ring*: $n-1$

d. *Bus*: one backbone and n drop lines

(c) *Peer-to-peer* processes are processes on two or more devices communicating at a same layer

(d) The *data link layer* is responsible for

a. *framing data bits*

b. *providing the physical addresses of the sender/receiver*

c. *data rate control*

d. *detection and correction of damaged and lost frames*

(d) The address field defines the *end-to-end* (source to destination) addressing.

(e) *Piggybacking* is used to improve the efficiency of bidirectional transmission.

When a frame is carrying data from A to B, it can also carry control information

about frames from B; when a frame is carrying data from B to A, it can also carry

control information about frames from A.

(f) The *preamble* is a 56-bit field that provides an alert and timing pulse. It is added to the frame at the physical layer and is not formally part of the frame. SFD is a onebyte field that serves as a flag.

(g) A *layer-2 switch* is an N-port bridge with additional sophistication that allows

faster handling of packets

(h) In *CSMA/CD*, the protocol allows collisions to happen. If there is a collision, it

will be detected, destroyed, and the frame will be resent. *CSMA/CA* uses a technique

that prevents collision.

(i) A *hub* is a multiport repeater

(j) Members of a *VLAN* can send broadcast messages with the assurance that users in other groups will not receive these messages

(k) An ATM virtual connection is defined by two numbers: a *virtual path identifier (VPI)* and a *virtual circuit identifier (VCI)*.

(l) *Classful addressing* assigns an organization a Class A, Class B, or Class C block of addresses. *Classless addressing* assigns an organization a block of contiguous

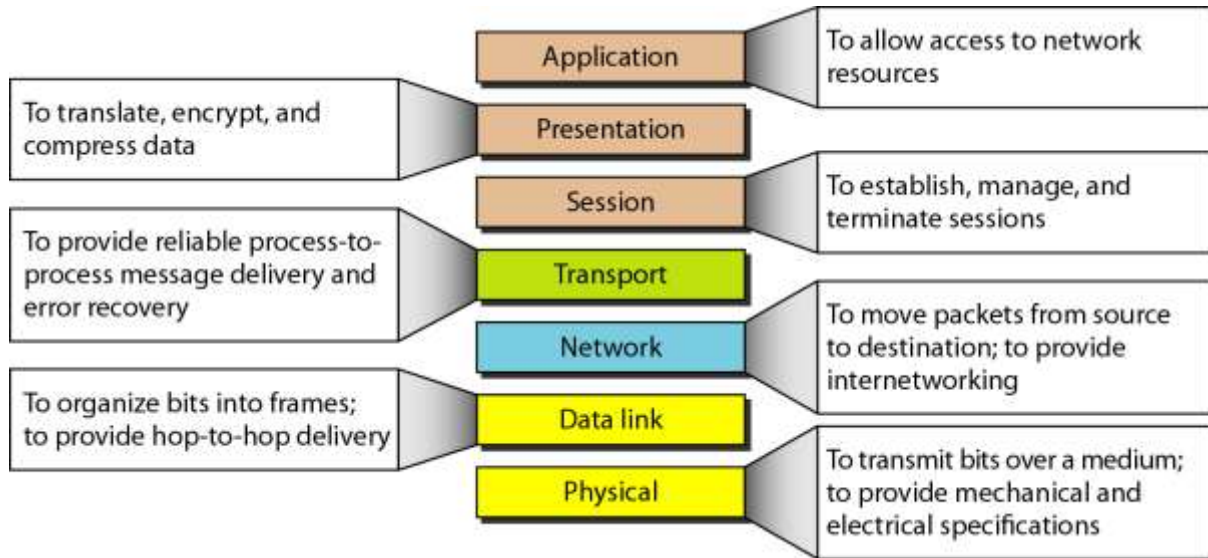
addresses based on its needs.

(m) The size of an ARP packet is *variable*, depending on the length of the logical and physical addresses used

Q-2 Write about the OSI model (reference model).

Ans-Established in 1947, the International Standards Organization (ISO) is a multinational body dedicated to worldwide agreement on international standards. An ISO standard that covers all aspects of network communications is the Open Systems Interconnection (OSI) model. It was first introduced in the late 1970s.

In this section we briefly describe the functions of each layer in the OSI model



Q-3 Distinguish different categories of UTP cables with their speeds.

Ans-

Category	Specification	Data Rate (Mbps)	Use
1	Unshielded twisted-pair used in telephone	< 0.1	Telephone
2	Unshielded twisted-pair originally used in T-lines	2	T-1 lines
3	Improved CAT 2 used in LANs	10	LANs
4	Improved CAT 3 used in Token Ring networks	20	LANs
5	Cable wire is normally 24 AWG with a jacket and outside sheath	100	LANs
5E	An extension to category 5 that includes extra features to minimize the crosstalk and electromagnetic interference	125	LANs
6	A new category with matched components coming from the same manufacturer. The cable must be tested at a 200-Mbps data rate.	200	LANs
7	Sometimes called SSTP (shielded screen twisted-pair). Each pair is individually wrapped in a helical metallic foil followed by a metallic foil shield in addition to the outside sheath. The shield decreases the effect of crosstalk and increases the data rate.	600	LANs

Q-4 Give the main functions of Data Link Layer.

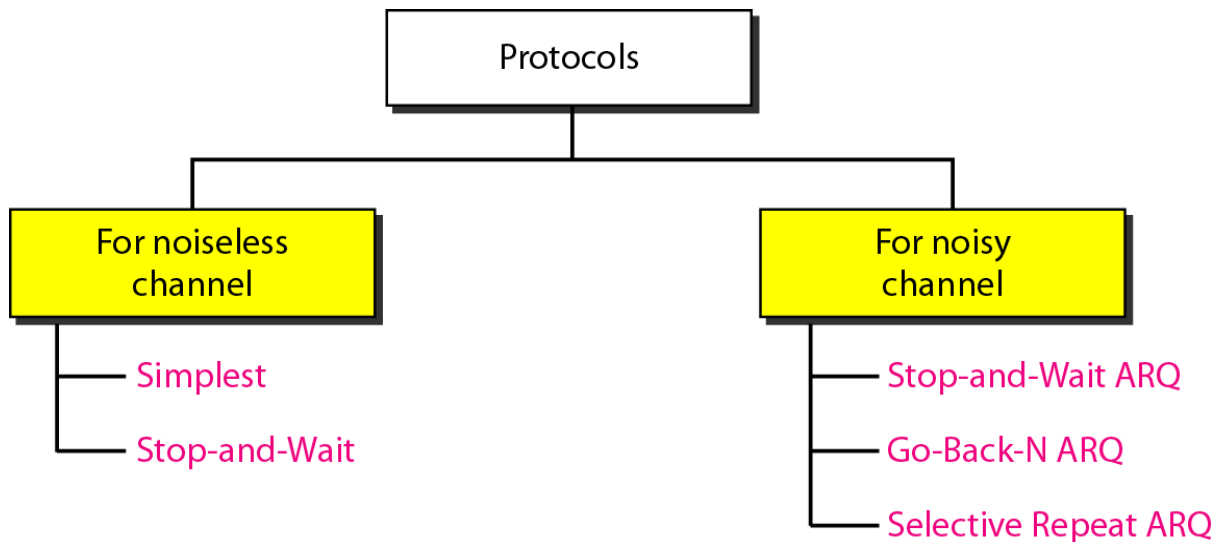
Ans-The two main functions of the data link layer are **data link control** and **media access control**. Data link control deals with the design and procedures for communication between two adjacent nodes: node-to-node communication. Media access control deals with procedures for sharing the link.

Q-5 Differentiate between Flow control and Error control.

Ans-**Flow control** refers to a set of procedures used to restrict the amount of data that the sender can send before waiting for acknowledgment. **Error control** refers to a set of procedures used to detect and correct errors.

Q-6 Explain different protocols for noisy channels.

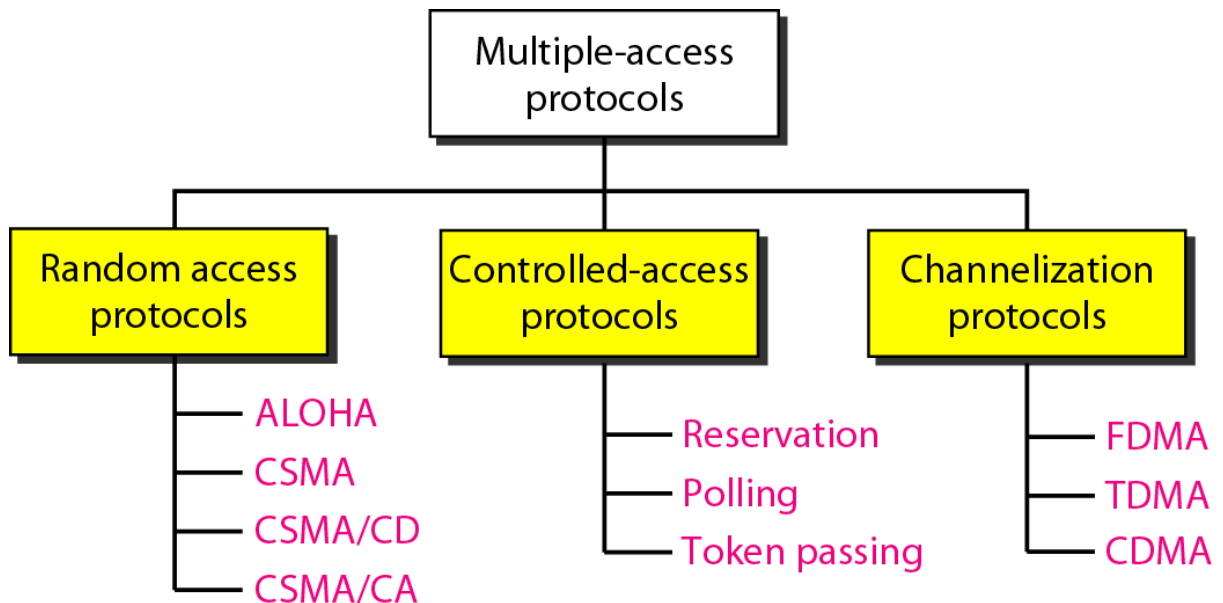
Ans-we discussed three protocols for noisy channels: the **Stop-and-Wait ARQ**, the **Go-Back-N ARQ**, and the **Selective-Repeat ARQ**



In the *Go-Back-N ARQ Protocol*, we can send several frames before receiving acknowledgments. If a frame is lost or damaged, all outstanding frames sent before that frame are resent. In the *Selective-Repeat ARQ protocol* we avoid unnecessary transmission by sending only the frames that are corrupted or missing. Both Go-Back-N and Selective-Repeat Protocols use *sliding windows*. In Go-Back-N ARQ, if m is the number of bits for the sequence number, then the size of the send window must be at most 2^m-1 ; the size of the receiver window is always 1. In Selective-Repeat ARQ, the size of the sender and receiver window must be at most 2^m-1 .

Q-7 Discuss Multiple Access Protocols.

Ans-



The three categories of multiple access protocols discussed in this chapter are *random access*, *controlled access*, and *channelization*.

In *controlled access methods*, the stations consult one another to find which station has the right to send. A station cannot send unless it has been authorized by other stations. We discuss three popular controlled-access methods: *reservation*, *polling*, and *token passing*.

In *random access* methods, there is no access control (as there is in controlled

access methods) and there is no predefined channels (as in channelization). Each station can transmit when it desires. This liberty may create *collision*.

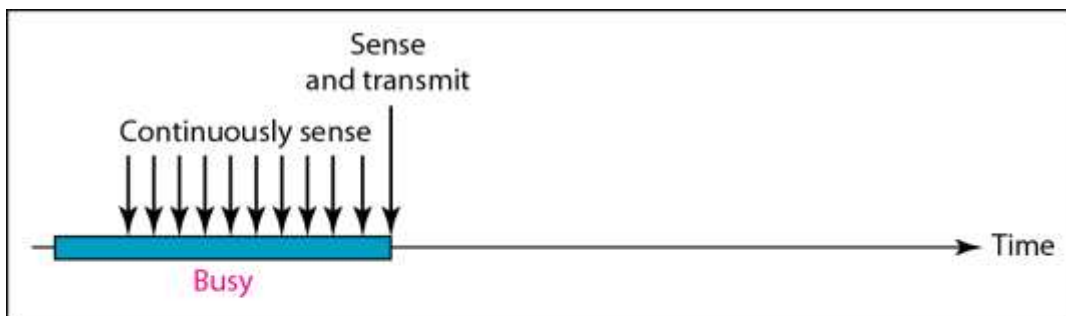
In a *random access* method, the whole available bandwidth belongs to the station that wins the contention; the other stations need to wait. In a *channelization* method, the available bandwidth is divided between the stations. If a station does not have data to send, the allocated channel remains idle.

Q-8 Explain the Persistent methods of CSMA.

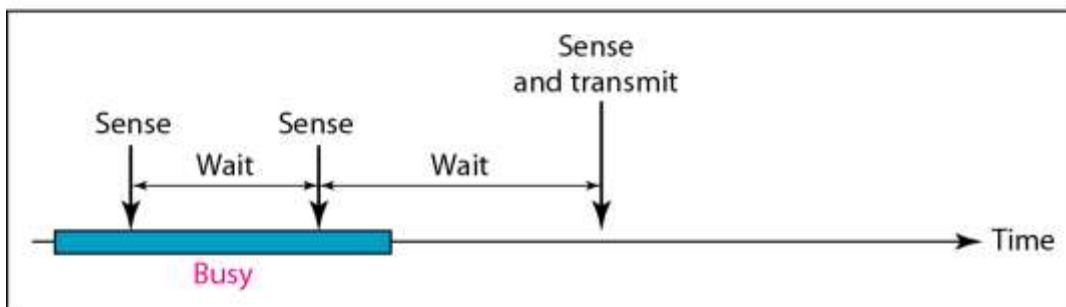
Ans-There are 3 types of persistent methods-

>1-persistent >nonpersistent >p-persistent

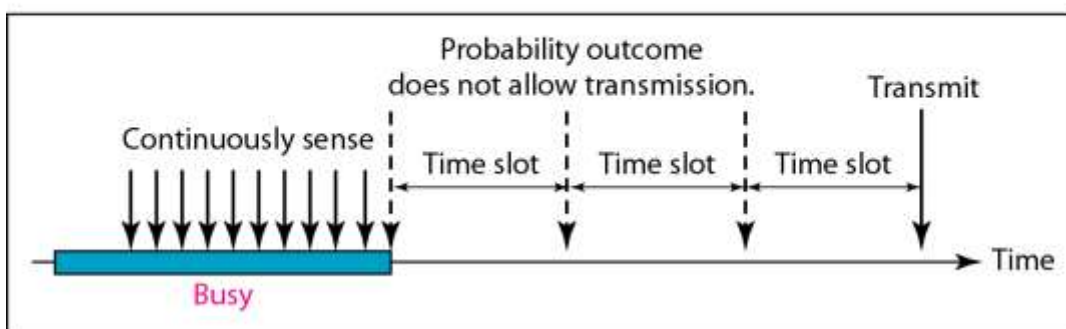
Behaviour of persistent methods-



a. 1-persistent

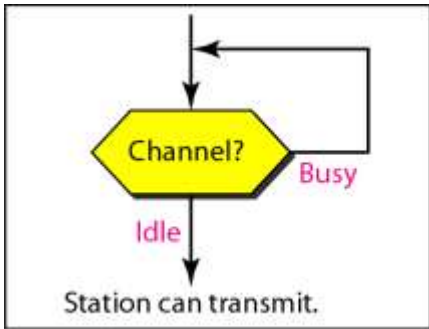


b. Nonpersistent

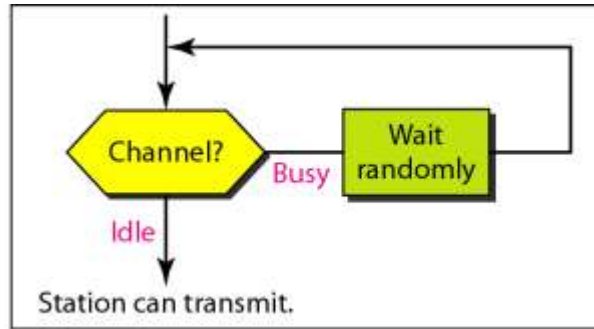


c. p-persistent

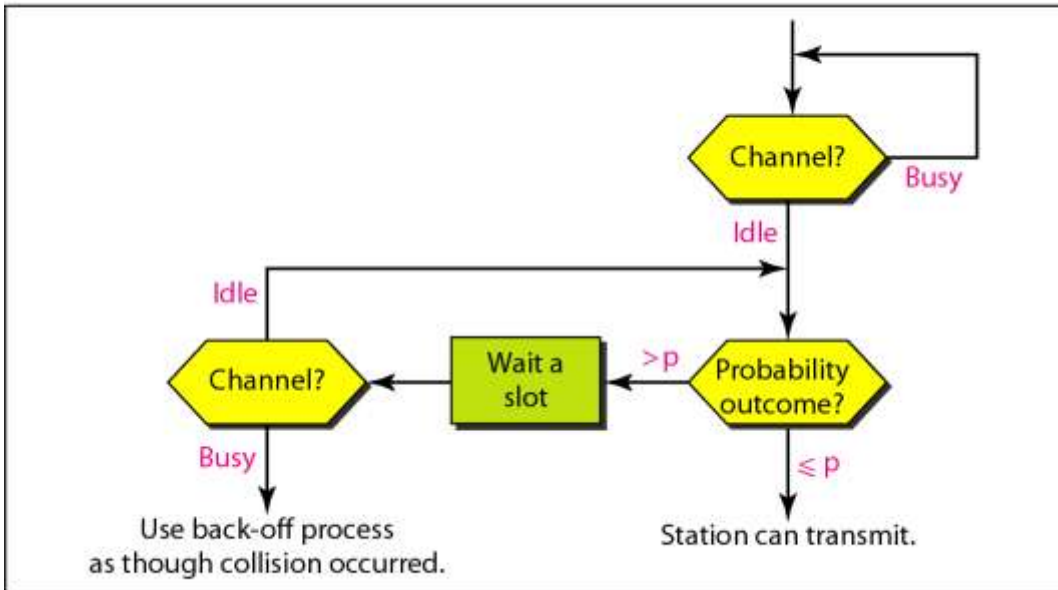
Flow diagrams –



a. 1-persistent



b. Nonpersistent



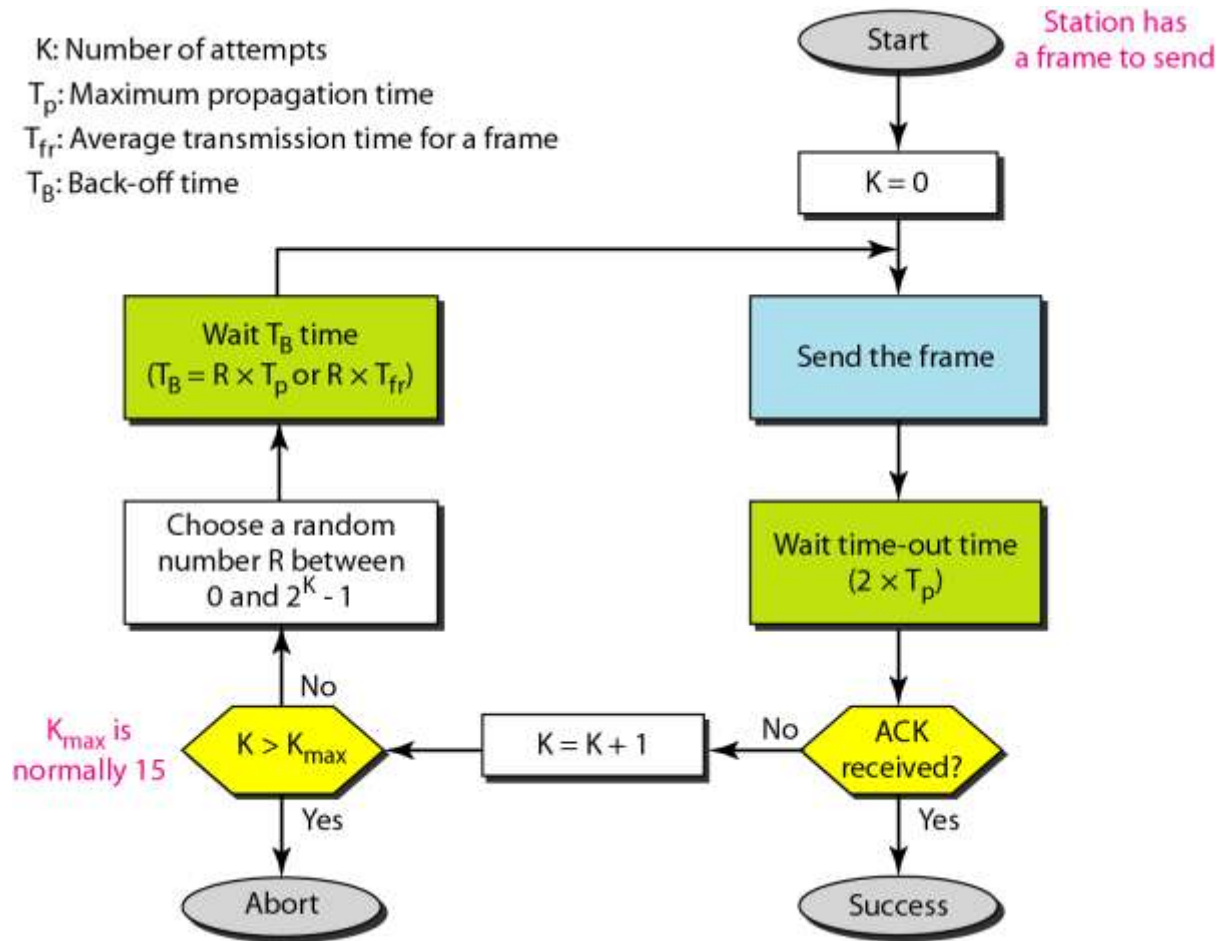
c. p-persistent

Q-9 Explain procedure for-

- (a) Pure aloha
- (b) CSMA/CD
- (c) CSMA/CA

Ans-(a)

K: Number of attempts
 T_p : Maximum propagation time
 T_{fr} : Average transmission time for a frame
 T_B : Back-off time



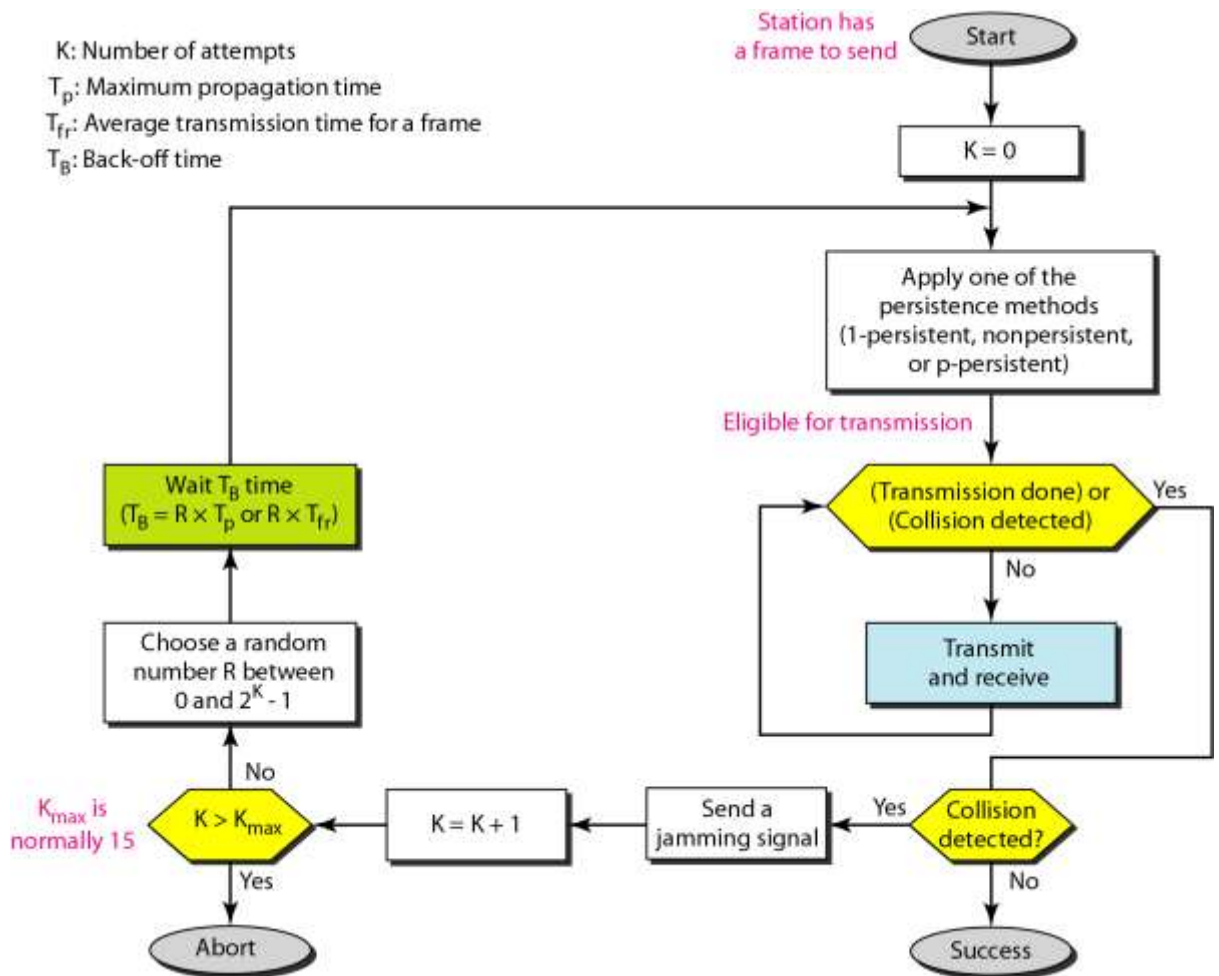
The throughput for pure ALOHA is

$$S = G \times e^{-2G}$$

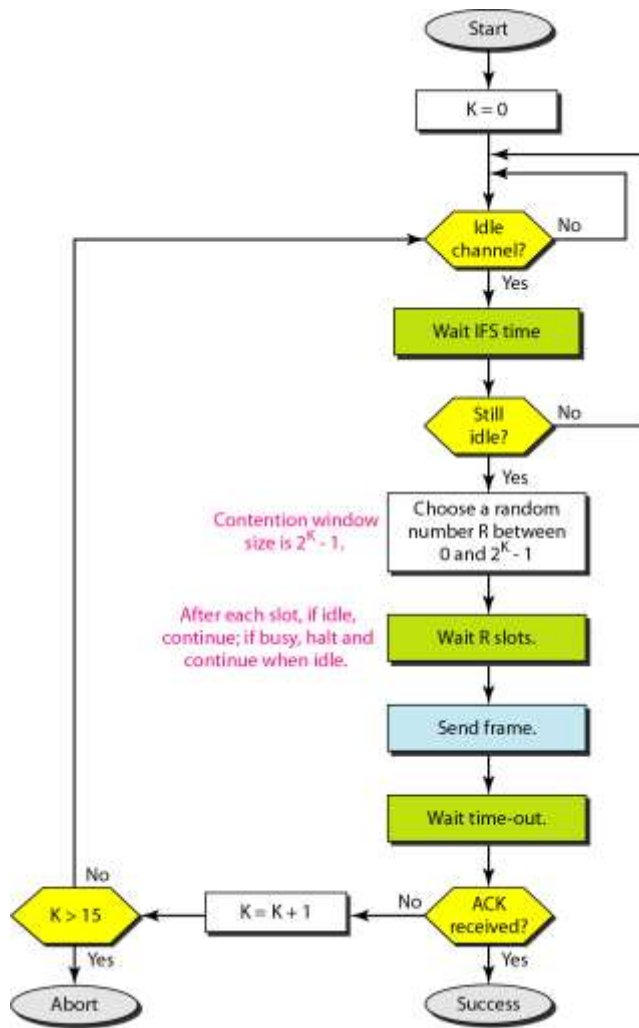
The maximum throughput

$$S_{\max} = 0.184 \text{ when } G = (1/2).$$

(b)

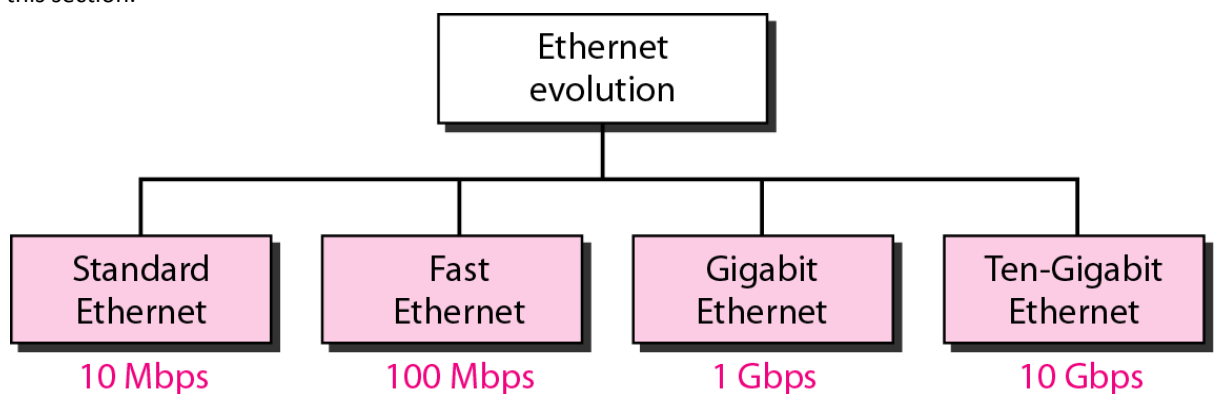


(c) In CSMA/CA, if the station finds the channel busy, it does not restart the timer of the contention window; it stops the timer and restarts it when the channel becomes idle.



Q-10 Discuss different standards of Ethernet.

Ans-The original Ethernet was created in 1976 at Xerox's Palo Alto Research Center (PARC). Since then, it has gone through four generations. We briefly discuss the Standard (or traditional) Ethernet in this section.



Summary of Standard Ethernet implementations

<i>Characteristics</i>	<i>10Base5</i>	<i>10Base2</i>	<i>10Base-T</i>	<i>10Base-F</i>
Media	Thick coaxial cable	Thin coaxial cable	2 UTP	2 Fiber
Maximum length	500 m	185 m	100 m	2000 m
Line encoding	Manchester	Manchester	Manchester	Manchester

Summary of Fast Ethernet implementations

<i>Characteristics</i>	<i>100Base-TX</i>	<i>100Base-FX</i>	<i>100Base-T4</i>
Media	Cat 5 UTP or STP	Fiber	Cat 4 UTP
Number of wires	2	2	4
Maximum length	100 m	100 m	100 m
Block encoding	4B/5B	4B/5B	
Line encoding	MLT-3	NRZ-I	8B/6T

Summary of Gigabit Ethernet implementations

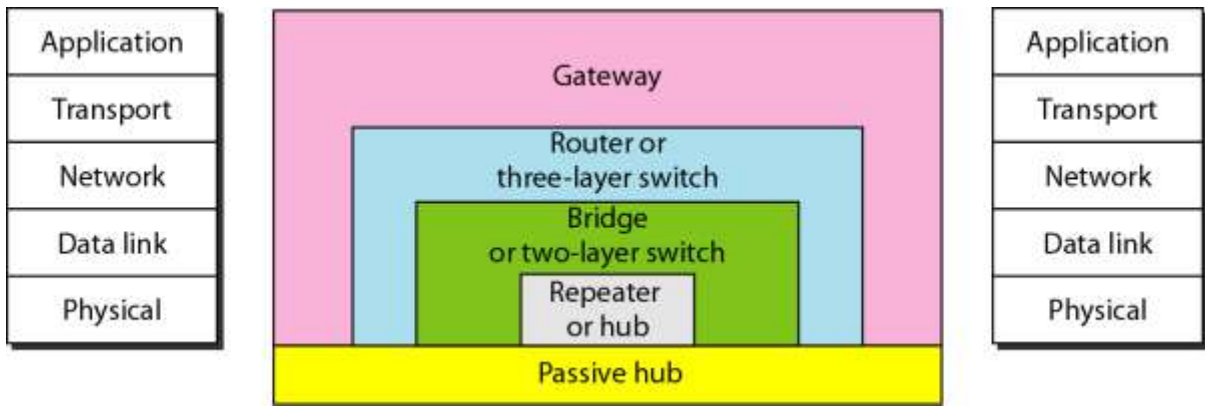
<i>Characteristics</i>	<i>1000Base-SX</i>	<i>1000Base-LX</i>	<i>1000Base-CX</i>	<i>1000Base-T</i>
Media	Fiber short-wave	Fiber long-wave	STP	Cat 5 UTP
Number of wires	2	2	2	4
Maximum length	550 m	5000 m	25 m	100 m
Block encoding	8B/10B	8B/10B	8B/10B	
Line encoding	NRZ	NRZ	NRZ	4D-PAM5

Summary of Ten-Gigabit Ethernet implementations

<i>Characteristics</i>	<i>10GBase-S</i>	<i>10GBase-L</i>	<i>10GBase-E</i>
Media	Short-wave 850-nm multimode	Long-wave 1310-nm single mode	Extended 1550-nm single mode
Maximum length	300 m	10 km	40 km

Q-11 Describe internetworking connecting devices in reference to layers.

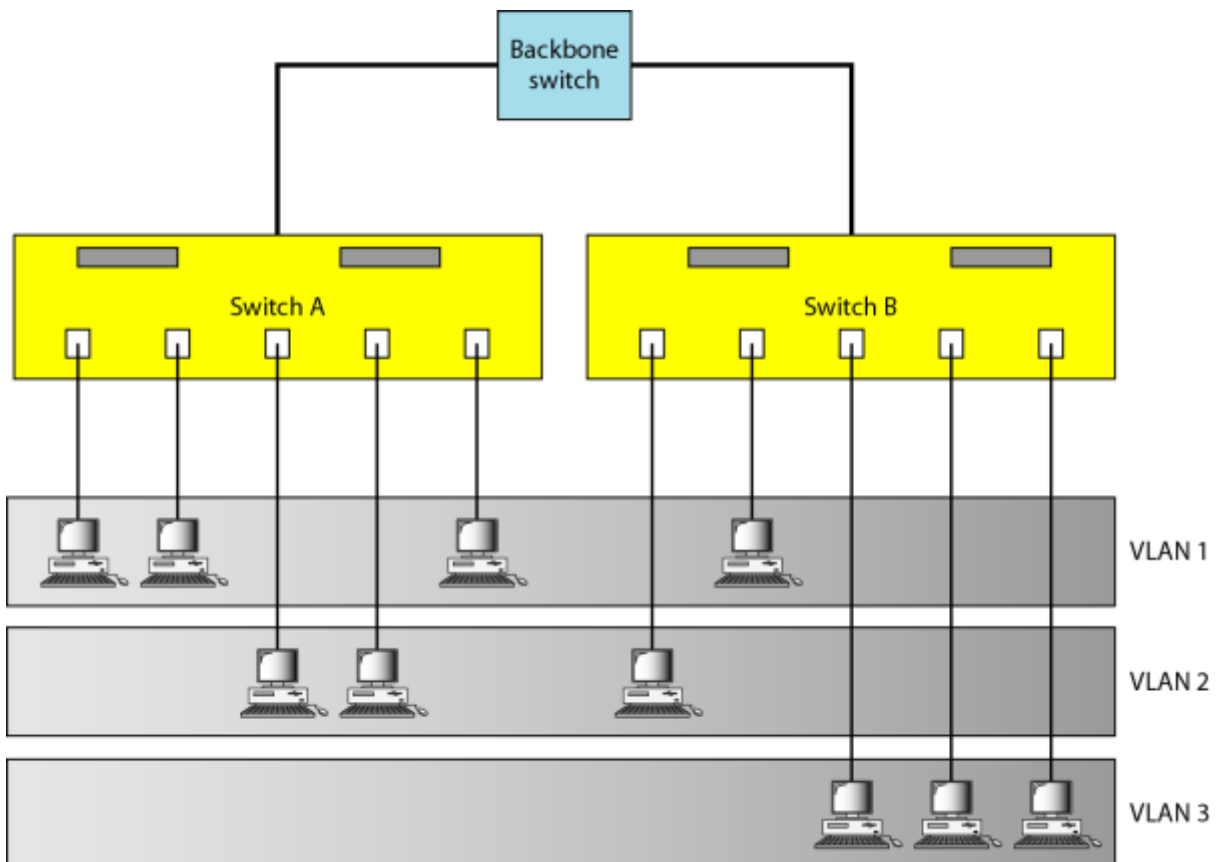
Ans- In this section, we divide connecting devices into five different categories based on the layer in which they operate in a network



A **bridge** has more overhead than a **repeater**. A **bridge** processes the packet at **two layers**; a **repeater** processes a frame at **only one layer**. A bridge needs to search a table and find the forwarding port as well as to regenerate the signal; a repeater only regenerates the signal. In other words, a bridge is also a repeater (and more); a repeater is not a bridge. A **transparent bridge** is a bridge in which the stations are completely unaware of the bridge's existence. If a bridge is added or deleted from the system, reconfiguration of the stations is unnecessary. A **hub** is a **multiport repeater**.

Q-12 What are VLANs.

Ans-We can roughly define a virtual local area network (VLAN) as a local area network configured by software, not by physical wiring.



VLANs create broadcast domains.

Q-13 (a) Find the class of each address.

- a. 00000001 00001011 00001011 11101111
- b. 11000001 10000011 00011011 11111111
- c. 14.23.120.8
- d. 252.5.15.111

Ans-Solution

- a. The first bit is 0. This is a class A address.
 - b. The first 2 bits are 1; the third bit is 0. This is a class C address.
 - c. The first byte is 14; the class is A.
 - d. The first byte is 252; the class is E.
- (b) An IPv4 packet has arrived with the first 8 bits as shown:

01000010

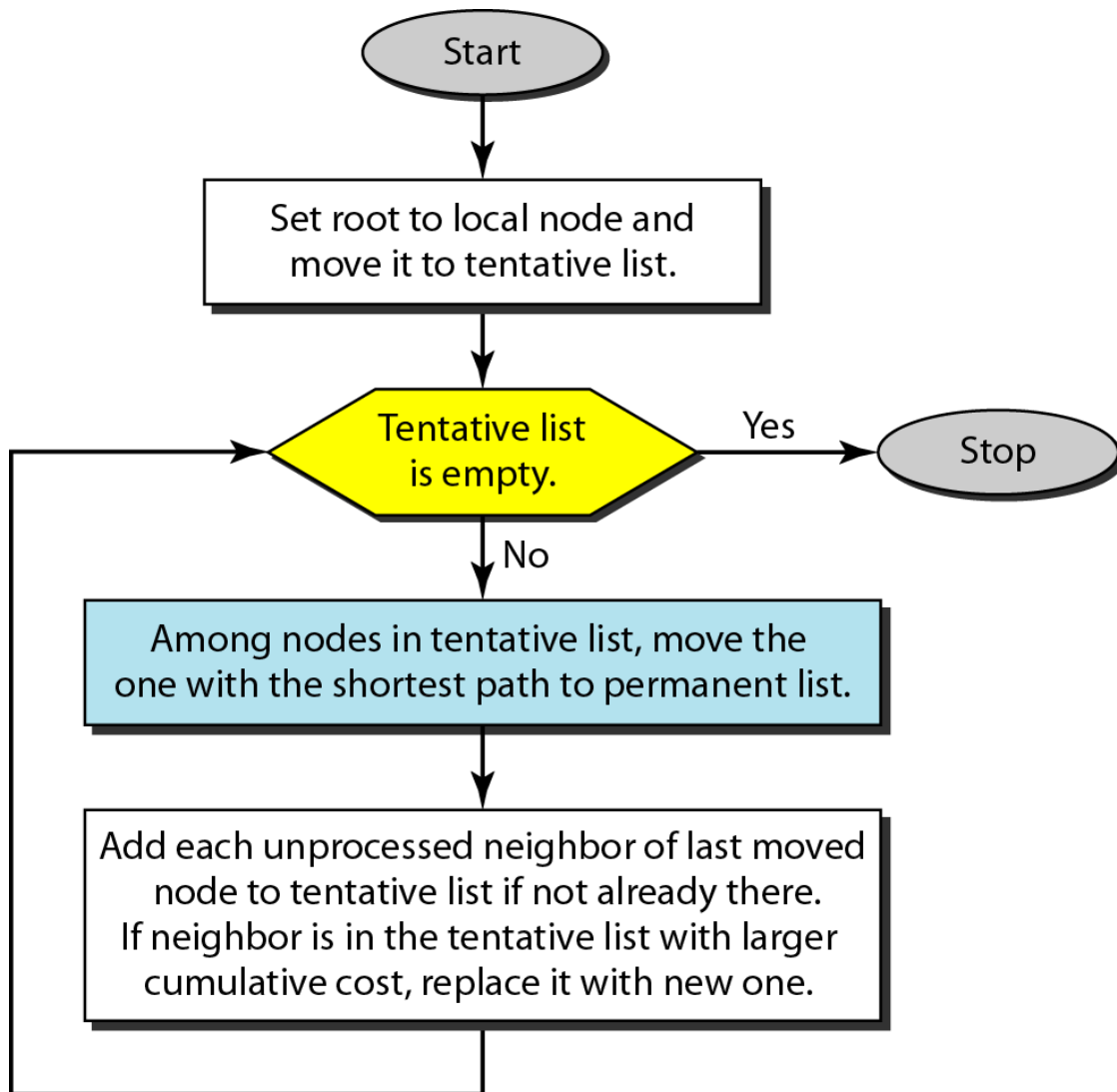
The receiver discards the packet. Why?

Ans-There is an error in this packet. The 4 leftmost bits (0100) show the version, which is correct. The next 4 bits (0010) show an invalid header length ($2 \times 4 = 8$). The minimum number of bytes in the header must be 20. The packet has been corrupted in transmission.

Q-14 Write difference between static and dynamic routing and Explain dijkstra routing algorithm.

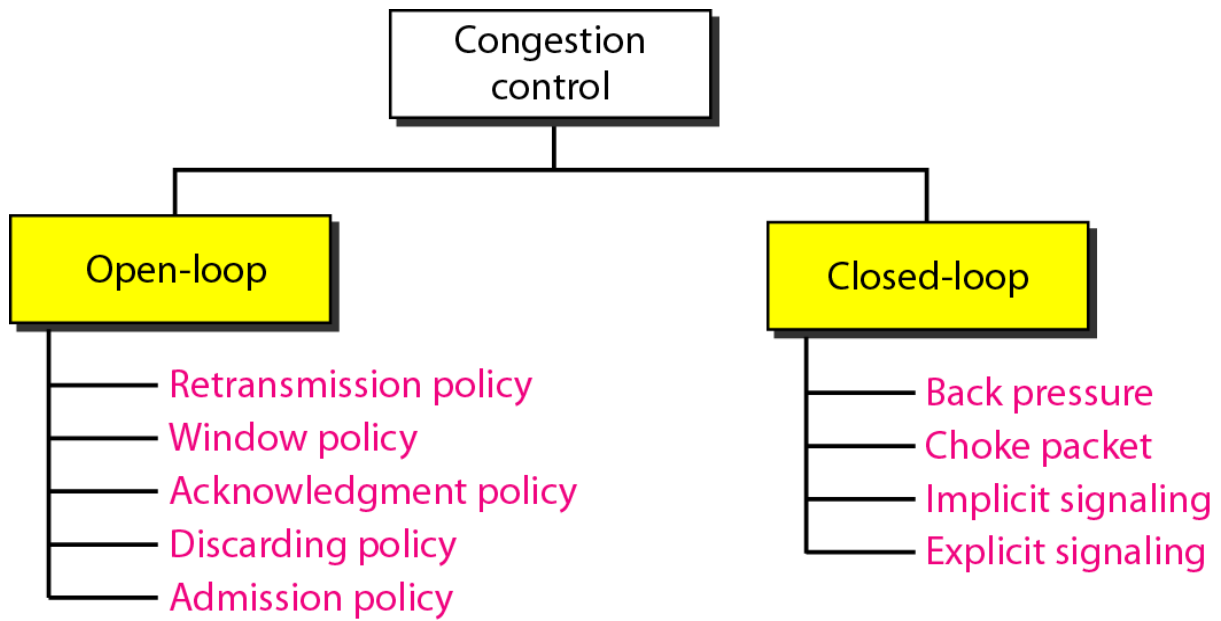
Ans-A routing table can be either static or dynamic. A *static routing* table contains information entered manually. A *dynamic routing table* is updated periodically by using one of the dynamic routing protocols such as RIP, OSPF, or BGP.

Dijkstra algorithm

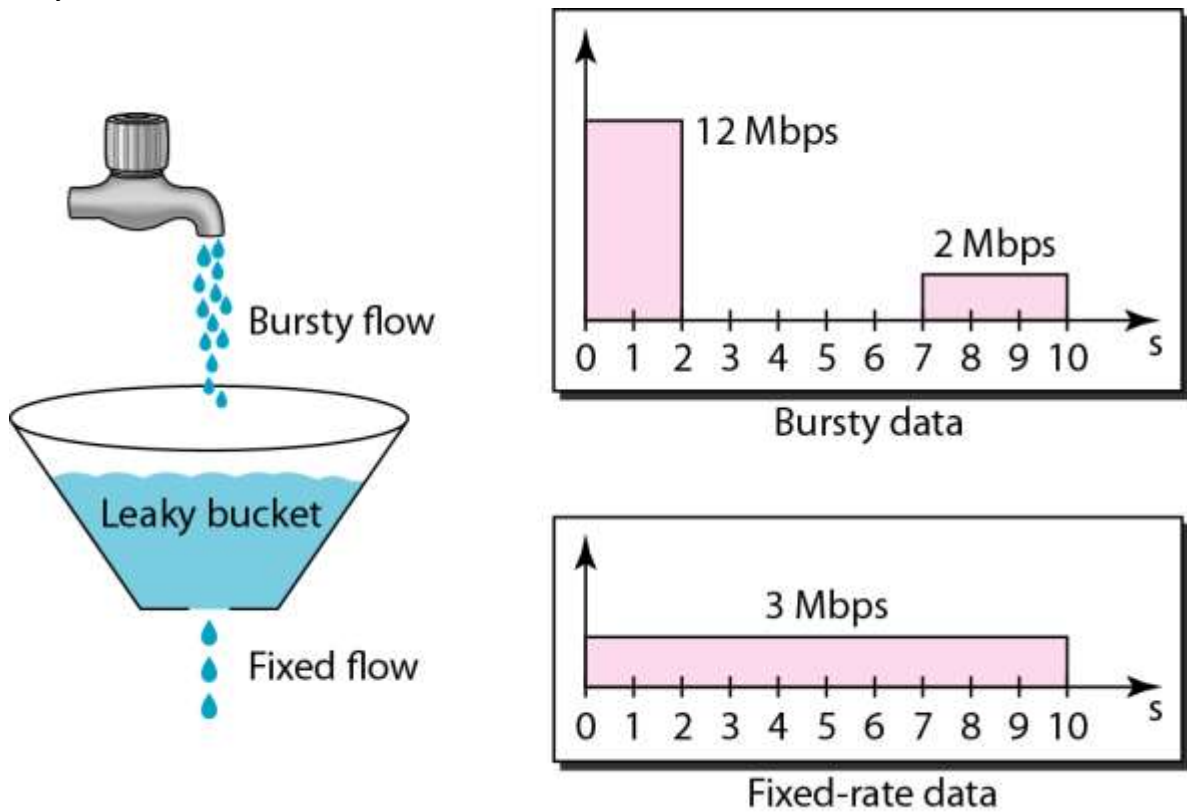


Q-15 Describe different open and closed congestion control and also explain Leaky bucket and Token bucket algo briefly.

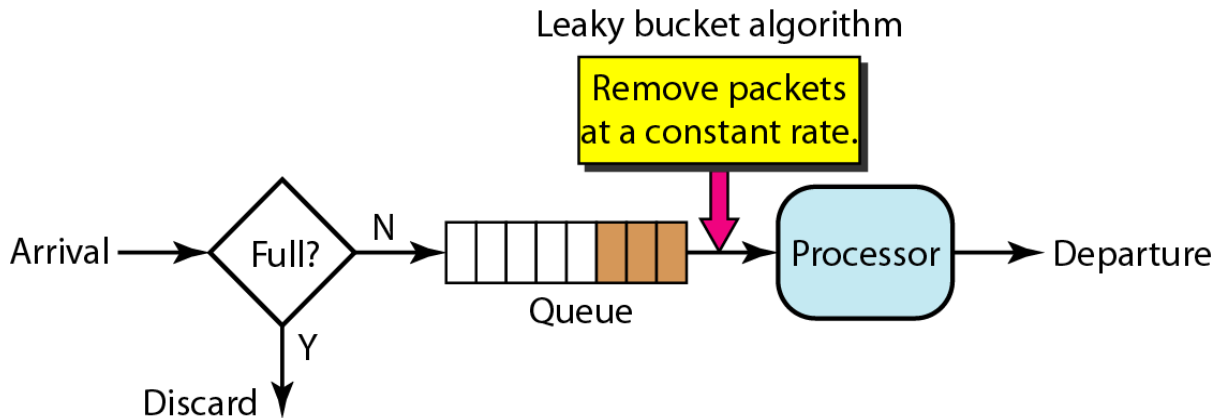
Ans-Congestion control refers to techniques and mechanisms that can either prevent congestion, before it happens, or remove congestion, after it has happened. In general, we can divide congestion control mechanisms into two broad categories: open-loop congestion control (prevention) and closed-loop congestion control (removal).



Leaky bucket

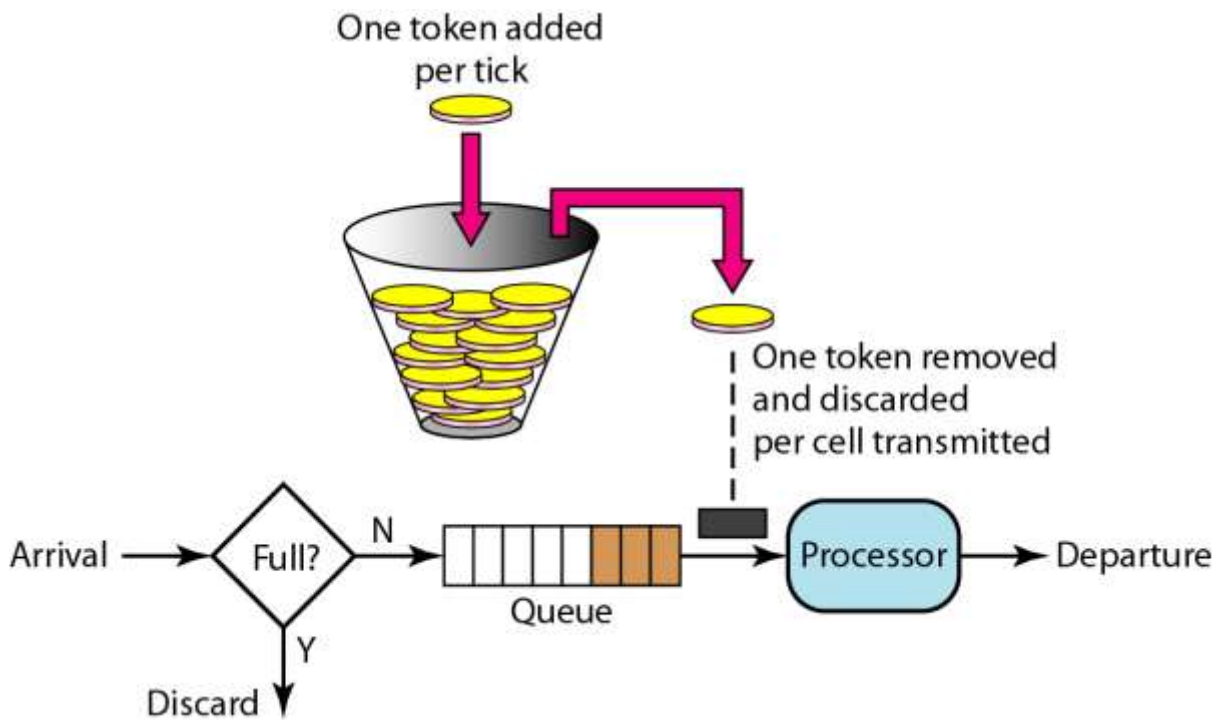


Leaky bucket implementation



A leaky bucket algorithm shapes bursty traffic into fixed-rate traffic by averaging the data rate. It may drop the packets if the bucket is full.

Token bucket



The token bucket allows bursty traffic at a regulated maximum rate.

Q-16 Define ISDN.

What is the difference between narrowband ISDN and broadband ISDN. Also give application of ISDN.

Ans-. **Integrated Services for Digital Network (ISDN)** is a set of communication standards for simultaneous digital transmission of voice, video, data, and other network services over the traditional circuits of the public switched telephone network

The **narrowband ISDN** is based on the use of a 64 kbps channel as the basic unit of switching and has a circuit switching orientation. The major technical contribution of the narrowband ISDN effort has been frame relay. The B-ISDN supports very high data rates (100s of Mbps) and has a packet switching orientation. The major technical contribution of the B-ISDN effort has been asynchronous transfer mode, also known as cell relay

Generally, narrowband describes telecommunication that carries voice information in a narrow band of frequencies. More specifically, the term has been used to describe a specific frequency range set aside by the U.S. FCC for mobile or radio services, including paging systems, from 50 cps to 64 Kbps

On the other hand, [The broadband ISDN](#) refers to telecommunication in which a wide band of frequencies is available to transmit information. Because a wide band of frequencies is available, information can be multiplexed and sent on many different frequencies or channels within the band concurrently, allowing more information to be transmitted in a given amount of time (much as more lanes on a highway allow more cars to travel on it at the same time)

Applications-

- * It has a high speed image applications that is used to transfer data between two or more users.
- * It also has a high speed data transfer as the bit transfer rate through ISDN is very high.
- * It also has very good voice service.
- * It is also used in the video conferencing in which we have used the various devices like camera, microphone, speakers, TV etc for carrying out communications with various users for formal purposes.
- * It also provides Additional telephone lines in the homes etc.