SHAMBHUNATH INSTITUTE OF ENGINEERING AND TECHNOLOGY

Subject Code: RCS-601 **Subject:** Computer Networks **B.Tech.** 3rd Year **SEMESTER-** VI

FIRST SESSIONAL EXAMINATION, EVEN SEMESTER, (2019-2020)

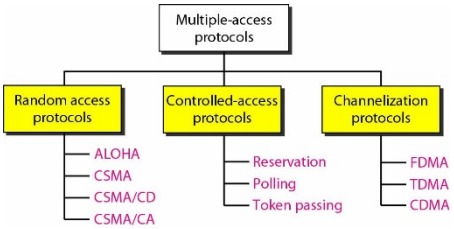
Branch: Computer Science & Engineering

Solution

SECTION – A

1. **(1*5 = 5)**

Q N	QUESTION
a.	Which of the layer in the OSI Model is optional layer and why? **Solution** : In OSI Model, Presentation layer is optional layer
b.	List the Categories and all the protocols of each categories of medium access control. **Solution:**



c.	A bit String 01111 011111 01111110 needs to be transmitted at the data link layer .What is the string actually transmitted after bit stuffing. **Solution:** Actual Transmitted bit: 01111011111**0**011111**0**10
d.	What are the no. of cable links required for n-devices connected in mesh, ring, bus & star topology? **Solution:** Mesh = n*(n-1)/2, Bus= n+1, Ring=n, Star= n
e.	Write the sizes of MAC address, IP address & Port address. **Solution:** MAC= 48 Bit, IP=32 Bit, Port= 16 Bit

SECTION - B

2. **(2*5 = 10)**

Q N	QUESTION
a.	In a certain communication channel, the signal power is 100W and the noise power is 10 W. In order to send information at the rate of 10 kbps. What is required bandwidth? **Solution:** signal power s= 100W, noise power n= 10 W , SNR= 10 W Rate r= 10 kbps Bandwidth=? We know Shannons Theorem $R= B*\log_2[1+SNR]$ $10* 10^3 =B* \log_2[1+10]$ $B= 10*10^3/\log_2 11$
b.	What are the reasons for using layered protocols? Distinguish between TCP/IP and OSI reference models. **Solution**

BASIS FOR COMPARISON	TCP/IP MODEL	OSI MODEL
Expands To	Transmission Control Protocol/ Internet Protocol	Open system Interconnect
Meaning	It is a client server model used for transmission of data over the internet.	It is a theoretical model which is used for computing system.
Number Of Layers	4 Layers	7 Layers
Developed by	Department of Defense (DoD)	ISO (International Standard Organization)
Tangible	Yes	No
Usage	Mostly used	Never used
Obeys	Horizontal approach	Vertical approach

c.	**Describe various Transmission Modes used in Computer Networks.** **Solution:** Transmission Modes in Computer Networks (Simplex, Half-Duplex and Full-Duplex) Transmission mode means transferring of data between two devices. It is also known as 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:-

	Simplex Mode Half-Duplex Mode Full-Duplex Mode **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. **Half-Duplex Mode** In half-duplex mode, each station can both transmit and receive, but not at the same time. When 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 direction 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 the directions. **Full-Duplex Mode** In full-duplex mode, both stations can transmit and receive simultaneously. In full duplex mode, signals going in one direction share the capacity of the link with signals going in other direction, this sharing can occur in two ways: 1. Either the link must contain two physically separate transmission paths, one for sending and other for receiving. 2. Or the capacity is divided between signals travelling in both directions. Full-duplex mode is used when communication in both direction 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 persons by a telephone line, through which both can talk and listen at the same time.
d.	Explain the three method of 1-persistent, p-persistent & n-persistent. **Solution:** There Are Three Different Type of CSMA Protocols (I) I-persistent CSMA (ii) Non- Persistent CSMA (iii) p-persistent CSMA (i) I-persistent CSMA • In this method, station that wants to transmit data continuously senses the channel to check whether the channel is idle or busy. • If the channel is busy, the station waits until it becomes idle. • When the station detects an idle-channel, it immediately transmits the frame with probability 1. Hence it is called I-persistent CSMA. • This method has the highest chance of collision because two or more stations may find channel to be idle at the same time and transmit their frames. • When the collision occurs, the stations wait a random amount of time and start allover again. (ii) Non-persistent CSMA • In this scheme, if a station wants to transmit a frame and it finds that the channel is busy (some other station is transmitting) then it will wait for fixed interval oftime. • After this time, it again checks the status of the channel and if the channel is.free it will transmit. • A station that has a frame to send senses the channel. • If the channel is idle, it sends immediately. • If the channel is busy, it waits a random amount of time and then senses the channel again. • In non-persistent CSMA the station does not continuously sense the channel for the purpose of capturing it when it detects the end of previous transmission. (iii) p-persistent CSMA • This method is used when channel has time slots such that the time slot duration is equal to or greater than the maximum propagation delay time. • Whenever a station becomes ready to send, it senses the channel. • If channel is busy, station waits until next slot. • If channel is idle, it transmits with a probability p. • With the probability q=l-p, the station then waits for the beginning of the next time slot. • If the next slot is also idle, it either transmits or waits again with probabilities p and q. • This process is repeated till either frame has been transmitted or another station has begun transmitting. • In case of the transmission by another station, the station acts as though a collision has occurred and it waits a random amount of time and starts again.

SECTION - C

3. Attempt any ONE part of the following: (1*5 = 5)

QN	QUESTION
a.	**Define the Network Topology and Compare their performance. How many cables required in Mesh topology having 140 computers using duplex communication mode?** **Solution:** **Types of Network Topology** The arrangement of a network which comprises of nodes and connecting lines via sender and receiver is referred as network topology. The various network topologies are : **a) Mesh Topology :** In mesh topology, every device is connected to another device via particular channel. Every device is connected with another via dedicated channels. These channels are known as links. • If suppose, N number of devices are connected with each other in mesh topology, then total number of ports that is required by each device is N-

1. In the Figure 1, there are 5 devices connected to each other, hence total number of ports required is 4.

- If suppose, N number of devices are connected with each other in mesh topology, then total number of dedicated links required to connect them is ${}^{N}C_2$ i.e. N(N-1)/2.
- Ex: there are 140 devices connected to each other, hence total number of links required is 140*139/2 = 9730.

Advantages of this topology :

- It is robust.
- Fault is diagnosed easily. Data is reliable because data is transferred among the devices through dedicated channels or links.
- Provides security and privacy.

Problems with this topology :

- Installation and configuration is difficult.
- Cost of cables are high as bulk wiring is required, hence suitable for less number of devices.
- Cost of maintenance is high.

b) Star Topology :

In star topology, all the devices are connected to a single hub through a cable. This hub is the central node and all others nodes are connected to the central node. The hub can be passive in nature i.e. not intelligent hub such as broadcasting devices, at the same time the hub can be intelligent known as active hubs. Active hubs have repeaters in them.

A star topology having four systems connected to single point of connection i.e. hub.

Advantages of this topology :

- If N devices are connected to each other in star topology, then the number of cables required to connect them is N. So, it is easy to set up.
- Each device require only 1 port i.e. to connect to the hub.

Problems with this topology :

- If the concentrator (hub) on which the whole topology relies fails, the whole system will crash down.
- Cost of installation is high.
- Performance is based on the single concentrator i.e. hub.

c) Bus Topology :

Bus topology is a network type in which every computer and network device is connected to single cable. It transmits the data from one end to another in single direction. No bi-directional feature is in bus topology.

A bus topology with shared backbone cable. The nodes are connected to the channel via drop lines.

Advantages of this topology :

- If N devices are connected to each other in bus topology, then the number of cables required to connect them is 1 which is known as backbone cable and N drop lines are required.
- Cost of the cable is less as compared to other topology, but it is used to built small networks.

Problems with this topology :

- If the common cable fails, then the whole system will crash down.
- If the network traffic is heavy, it increases collisions in the network. To avoid this, various protocols are used in MAC layer known as Pure Aloha, Slotted Aloha, CSMA/CD etc.

d) Ring Topology :

In this topology, it forms a ring connecting a devices with its exactly two neighboring devices.

A ring topology comprises of 4 stations connected with each forming a ring..

The following operations takes place in ring topology are :

1. One station is known as **monitor** station which takes all the responsibility to perform the operations.
2. To transmit the data, station has to hold the token. After the transmission is done, the token is to be released for other stations to use.

Advantages of this topology :

- The possibility of collision is minimum in this type of topology.
- Cheap to install and expand.

Problems with this topology :

- Troubleshooting is difficult in this topology.
- Addition of stations in between or removal of stations can disturb the whole topology.

e) Hybrid Topology :

This topology is a collection of two or more topologies which are described above. This is a scalable topology which can be expanded easily. It is reliable one but at the same it is a costly topology.

b. A system is designed to Sample Analog Signals convert them to Digital form with 4-bit converter and transmit them. What bit rate is required? if the Analog Signal consist of frequencies between 400 Hz to 3400 Hz. Also calculate the Baud Rate.

Solution:

Frequency Bandwidth = 3400-400= 3000 Hz, $L=2^4=16$

Data Rate = $2* B* \log_2 L$ = 2400bps

Baud Rate= bit rate/bit per symbol

=2400/4=600 baud

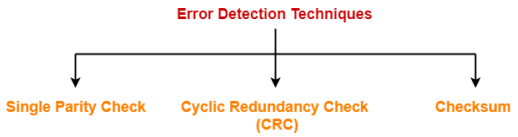
4. Attempt any ONE part of the following: (1*5 = 5)

Q N	QUESTION
a.	What are the different types of error detection methods? Explain CRC error detection technique using generator polynomial $\mathbf{x^4 + x^3 + 1}$

and data **11100011**.

Error Detection in Computer Networks-

Error detection is a technique that is used to check if any error occurred in the data during the transmission.



Cyclic Redundancy Check-

- Cyclic Redundancy Check (CRC) is an error detection method.
- It is based on binary division.

CRC Generator-

- CRC generator is an algebraic polynomial represented as a bit pattern.
- Bit pattern is obtained from the CRC generator using the following rule-

The power of each term gives the position of the bit and the coefficient gives the value of the bit.

b.

Consider building a CSMA/CD network running at 1 Gbps over a 1KM cable with no repeaters. The Signal Speed in the cable is 200,000 km/sec. What is the minimum frame size?

Solution: There is CSMA/CD network

Rate =1gbps $= 1*10^9$ bps Length of Cable= 1km

Signal Speed V= 200000 km/sec

Transmission Time(T_t)= Frame Size(F)\Rate(R)

Propagation Time (T_p)= Signal Speed(V)\ Distance of Cable(D)

In CSMA/CD

$T_t = 2* T_p \Rightarrow$ F\R= 2* D\V

F=1000 bits

5. Attempt any ONE part of the following: **(1*5 = 5)**

Q	QUESTION
a.	(1) Pure ALOHA Vs Slotted ALOHA

BASIS FOR COMPARISON	**PURE ALOHA**	**SLOTTED ALOHA**
Introduced	Introduced by Norman Abramson and his associates at the University of Hawaii in 1970.	Introduced by Roberts in 1972.
Frame Transmission	The user can transmit the data frame whenever the station has the data to be transmitted.	The user has to wait till the next time slot start, to transmit the data frame.
Time	In Pure ALOHA the time is continuous.	In Slotted ALOHA the time is discrete.
Successful Transmission	The probability of successful transmission of the data frame is: S= G* e^-2G	The probability of successful transmission of the data frame is: S= G*e^-G
Synchronization	The time is not globally synchronized.	The time here is globally synchronized.
Throughput	The maximum throughput occurs at G = 1/2 which is 18%.	The maximum throughput occurs at G = 1 which is 37%.

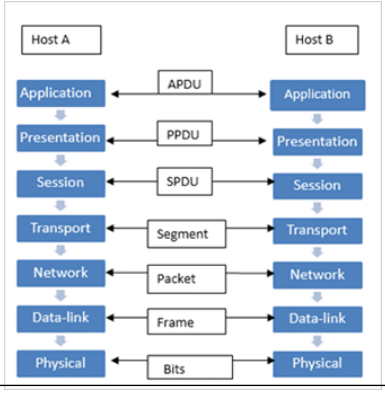
(2) TCP Vs UDP

BASIS FOR COMPARISON	**TCP**	**UDP**
Meaning	TCP establishes a connection between the computers before transmitting the data	UDP sends the data directly to the destination computer without checking whether the system is ready to receive or not
Expands to	Transmission Control Protocol	User Datagram Protocol
Connection Type	Connection Oriented	Connection Less
Speed	Slow	Fast
Reliability	Highly Reliable	Unreliable
Header Size	20 Bytes	8 Bytes

	Acknowledgement	It takes acknowledgement of data and has the ability to retransmit if the user requests.	It neither takes acknowledgement, nor it retransmits the lost data.
	Protocol connection setup	Connection-oriented, the connection must be established prior to transmission	Connectionless, data is sent without setup
	Applications and protocols	FTP, Telnet, SMTP, IMAP etcetera.	DNS, BOOTP, DHCP, TFTP etc.

b. Define layered architecture and peer to peer process of the **OSI Reference Model**.

Solution:



Layer	Name	Function
Layer 7	Application	To allow access to network resources.
Layer 6	Presentation	To translate, encrypt and compress data.
Layer 5	Session	To establish, manage, and terminate the session
Layer 4	Transport	The transport layer builds on the network layer to provide data transport from a process on a source machine to a process on a destination machine.
Layer 3	Network	To provide internetworking To move packets from source to destination
Layer 2	Data Link	To organize bits into frames To provide hop-to-hop delivery
Layer 1	Physical	To transmit bits over a medium To provide mechanical and electrical specifications