

## 6.2 Part A Questions with Answers & Part B Questions

### UNIT – I - DATA COMMUNICATION

#### 1. What is mean by data communication?

Data communication is the exchange of data (in the form of 1s and 0s) between two devices via some form of transmission medium (such as a wire cable).

#### 2. What are the three criteria necessary for an effective and efficient network?

The most important criteria are performance, reliability and security. Performance of the network depends on number of users, type of transmission medium, the capabilities of the connected h/w and the efficiency of the s/w. Reliability is measured by frequency of failure, the time it takes a link to recover from the failure and the network's robustness in a catastrophe. Security issues include protecting data from unauthorized access and viruses.

#### 3. What are the three fundamental characteristics determine the effectiveness of the data communication system?

The effectiveness of the data communication system depends on three fundamental characteristics:

Delivery: The system must deliver data to the correct destination.

Accuracy: The system must deliver data accurately.

Timeliness: The system must deliver data in a timely manner.

#### 4. What are the advantages of distributed processing?

Advantages of distributed processing include security/encapsulation, distributed databases, faster problem solving, security through redundancy and collaborative processing.

#### 5. Why are protocols needed?

In networks, communication occurs between the entities in different systems. Two entities cannot just send bit streams to each other and expect to be understood. For communication, the entities must agree on a protocol. A protocol is a set of rules that govern data communication.

#### 6. Why are standards needed?

Co-ordination across the nodes of a network is necessary for an efficient communication. If there are no standards, difficulties arise. A standard provides a model or basis for development to which everyone has agreed.

#### 7. For n devices in a network, what is the number of cable links required for a mesh and ring topology?

Mesh topology –  $n(n-1)/2$

Ring topology – n

#### 8. What is the difference between a passive and an active hub?

An active hub contains a repeater that regenerates the received bit patterns before

sending them out. A passive hub provides a simple physical connection between the attached devices.

**9. Distinguish between peer-to-peer relationship and a primary-secondary relationship.**

Peer-to-peer relationship: All the devices share the link equally.

Primary-secondary relationship: One device controls traffic and the others must transmit through it.

**10. Assume 6 devices are arranged in a mesh topology. How many cables are needed? How many ports are needed for each device?**

Number of cables =  $n(n-1)/2 = 6(6-1)/2 = 15$

Number of ports per device =  $n-1 = 6-1 = 5$

**11. Group the OSI layers by function.**

The seven layers of the OSI model belonging to three subgroups. Physical, data link and network layers are the network support layers; they deal with the physical aspects of moving data from one device to another. Session, presentation and application layers are the user support layers; they allow interoperability among unrelated software systems. The transport layer ensures end-to-end reliable data transmission.

**12. What are header and trailers and how do they get added and removed?**

Each layer in the sending machine adds its own information to the message it receives from the layer just above it and passes the whole package to the layer just below it. This information is added in the form of headers or trailers. Headers are added to the message at the layers 6,5,4,3, and 2. A trailer is added at layer 2. At the receiving machine, the headers or trailers attached to the data unit at the corresponding sending layers are removed, and actions appropriate to that layer are taken.

**13. The transport layer creates a communication between the source and destination. What are the three events involved in a connection?**

Creating a connection involves three steps: connection establishment, data transfer and connection release.

**14. What is the DC component?**

Direct current is a zero-frequency signal with constant amplitude.

**15. How does NRZ-L differ from NRZ-I?**

In the NRZ-L sequence, positive and negative voltages have specific meanings: positive for 0 and negative for 1. In the NRZ-I sequence, the voltages are meaningless. Instead, the receiver looks for changes from one level to another as its basis for recognition of 1s.

**17. What are the functions of a DTE? What are the functions of a DCE?**

Data terminal equipment is a device that is an information source or an information sink. It is connected to a network through a DCE.

Amplitude

Time

1 0 0 0 0 0 0 0 0 0 1 0 0

3

Data circuit-terminating equipment is a device used as an interface between a DTE and a network.

**17. What does the electrical specification of EIA-232 describe?**

The electrical specification of EIA-232 defines that signals other than data must be sent using OFF as less than -3 volts and ON as greater than +3 volts. The data must be transmitted using NRZ-L encoding.

**18. Discuss the mode for propagating light along optical channels.**

There are two modes for propagating light along optical channels, multimode and single mode.

Multimode: Multiple beams from a light source move through the core in different paths.

Single mode: Fiber with extremely small diameter that limits beams to a few angles, resulting in an almost horizontal beam.

**19. What is refraction?**

The phenomenon related to the bending of light when it passes from one medium to another.

**20. What are the responsibilities of data link layer?**

Specific responsibilities of data link layer include the following.

- a) Framing
- b) Physical addressing
- c) Flow control
- d) Error control
- e) Access control

**21. Mention the types of errors.**

There are 2 types of errors

- a) Single-bit error.
- b) Burst-bit error.

**22. Define the following terms.**

Single bit error: The term single bit error means that only one bit of a given data unit (such as byte character/data unit or packet) is changed from 1 to 0 or from 0 to 1.

Burst error: Means that 2 or more bits in the data unit have changed from 1 to 0 from 0 to 1.

**23. What is redundancy?**

It is the error detecting mechanism, which means a shorter group of bits or extra bits may be appended at the destination of each unit.

**24. List out the available detection methods.**

There are 4 types of redundancy checks are used in data communication.

- a) Vertical redundancy checks (VRC).
- b) Longitudinal redundancy checks (LRC).
- c) Cyclic redundancy checks (CRC).
- d) Checksum.

**25. Write short notes on VRC.**

The most common and least expensive mechanism for error detection is the vertical redundancy check (VRC) often called a parity check. In this technique a redundant bit called a parity bit, is appended to every data unit so, that the total number of 0's in the unit (including the parity bit) becomes even.

**26. Write short notes on LRC.**

In longitudinal redundancy check (LRC), a block of bits is divided into rows and a redundant row of bits is added to the whole block.

**27. Write short notes on CRC.**

The third and most powerful of the redundancy checking techniques is the cyclic redundancy checks (CRC) CRC is based on binary division. Here a sequence of redundant bits, called the CRC remainder is appended to the end of data unit.

**28. Write short notes on CRC generator.**

A CRC generator uses a modulo-2 division.

- 1) In the first step, the 4-bit divisor is subtracted from the first 4 bit of the dividend.
- 2) □ Each bit of the divisor is subtracted from the corresponding bit of the dividend without disturbing the next higher bit.

**29. Write short notes on CRC checker.**

A CRC checker functions exactly like a generator. After receiving the data appended with the CRC it does the same modulo-2 division. If the remainder is all 0's the CRC is dropped and the data accepted. Otherwise, the received stream of bits is discarded and the data is resent.

**30. Give the essential properties for polynomial.**

A polynomial should be selected to have at least the following properties.

- a) It should not be
- b) It should be divisible by  $(x+1)$ .

**31. Define checksum.**

The error detection method used by the higher layer protocol is called checksum. Checksum is based on the concept of redundancy.

**32. What are the steps followed in checksum generator?**

The sender follows these steps

- a) The units are divided into k sections each of n bits.
- b) All sections are added together using 2's complement to get the sum.
- c) The sum is complemented and become the checksum.
- d) The checksum is sent with the data.

**33. List out the steps followed is checksum checker side.**

The receiver must follow these steps

- a) The unit is divided into k section each of n bits.
- b) All sections are added together using 1's complement to get the sum.
- c) The sum is complemented.
- d) If the result is zero.

**34. Write short notes on error correction.**

It is the mechanism to correct the errors and it can be handled in 2 ways.

- a) When an error is discovered, the receiver can have the sender retransmit the entire data unit.
- b) A receiver can use an error correcting coder, which automatically corrects certain errors.

**35. Mention the types of error correcting methods.**

There are 2 error-correcting methods.

- a) Single bit error correction
- b) Burst error correction.

**36. What is the purpose of hamming code?**

A hamming code can be designed to correct burst errors of certain lengths. So the simple strategy used by the hamming code to correct single bit errors must be redesigned to be applicable for multiple bit correction.

**37. Define flow control.**

Flow control refers to a set of procedures used to restrict the amount of data. The sender can send before waiting for acknowledgment.

**38. What is a buffer?**

Each receiving device has a block of memory called a buffer, reserved for storing incoming data until they are processed.

**39. Mention the categories of flow control.**

There are 2 methods have been developed to control flow of data across communication links.

- a) Stop and wait- send one from at a time.
- b) Sliding window- send several frames at a time.

**UNIT II**

**NETWORK LAYER**

**1. What are the network support layers and the user support layers?**

Network support layers:

The network support layers are Physical layer, Data link layer and Network layer. These deals with electrical specifications, physical connection, transport timing and reliability.

User support layers:

The user support layers are: Session layer, Presentation layer, Application layer. These allow interoperability among unrelated software system.

**2. With a neat diagram explain the relationship of IEEE Project to the OSI model?**

The IEEE has subdivided the data link layer into two sub layers:

- 1) Logical link control (LLC)
- 2)Medium access control (MAC)

LLC is non-architecture specific. The MAC sub layer contains a number of distinct modules, each carries proprietary information specific to the LAN product being used.

**3. What are the functions of LLC?**

The IEEE project 802 models takes the structure of an HDLC frame and divides it into 2 sets of functions. One set contains the end user portion of the HDLC frame – the Other layers

- Network
- Data link
- Physical
- Other layers

- Network
- Logical Link Control
- Media Access Control
- Physical

logical address, control information, and data. These functions are handled by the IEEE802.2 logical link control (LLC) protocol.

#### **4. What are the functions of MAC?**

MAC sub layer resolves the contention for the shared media. It contains synchronization, flag, flow and error control specifications necessary to move information from one place to another, as well as the physical address of the next station to receive and route a packet.

#### **5. What is protocol data unit?**

The data unit in the LLC level is called Protocol Data Unit (PDU). It contains four fields. □

- 1) Destination Service Point Address (DSAP)
- 2) Source Service Access Point
- 3) Control field
- 4) Information field

#### **6. What are headers and trailers and how do they get added and removed?**

The control data added to the beginning of a data is called headers. The control data added to the end of a data is called trailers. At the sending machine, when the message passes through the layers each layer adds the headers or trailers. At the receiving machine, each layer removes the data meant for it and passes the rest to the next layer.

#### **7. What are the responsibilities of network layer?**

The network layer is responsible for the source-to-destination delivery of packet across multiple network links. The specific responsibilities of network layer include the following:

- 1) Logical addressing.
- 2) Routing.

#### **8. What is a virtual circuit?**

A logical circuit made between the sending and receiving computers. The connection is made after both computers do handshaking. After the connection, all packets follow the same route and arrive in sequence.

#### **9. What are data grams?**

In datagram approach, each packet is treated independently from all others. Even when one packet represents just a place of a multipacket transmission, the network treats it although it existed alone. Packets in this technology are referred to as datagram.

**10. What are the two types of implementation formats in virtual circuits?**

Virtual circuit transmission is implemented in 2 formats.

- 1) Switched virtual circuit
- 2) Permanent virtual circuit.

**11. What is meant by switched virtual circuit?**

Switched virtual circuit format is comparable conceptually to dial-up line in circuit switching. In this method, a virtual circuit is created whenever it is needed and exists only for the duration of specific exchange.

**12. What is meant by Permanent virtual circuit?**

Permanent virtual circuits are comparable to leased lines in circuit switching. In this method, the same virtual circuit is provided between two uses on a continuous basis. The circuit is dedicated to the specific uses.

**13. Define Routers.**

DSAP SSAP Control Information

Routers relay packets among multiple interconnected networks. They Route packets from one network to any of a number of potential destination networks on Internet routers operate in the physical, data link and network layer of OSI model.

**14. What is meant by hop count?**

The pathway requiring the smallest number of relays, it is called hop-count routing, in which every link is considered to be of equal length and given the value one.

**15. How can the routing be classified?**

The routing can be classified as,

- 1)  Adaptive routing
- 2)  Non-adaptive routing.

**16. What is time-to-live or packet lifetime?**

As the time-to-live field is generated, each packet is marked with a lifetime, usually the number of hops that are allowed before a packet is considered lost and accordingly, destroyed. The time-to-live determines the lifetime of a packet.

**17. What is meant by brouter?**

A brouter is a single protocol or multiprotocol router that sometimes act as a router and sometimes act as a bridge.

**18. Write the keys for understanding the distance vector routing.**

The three keys for understanding the algorithm are

- 1) Knowledge about the whole networks
- 2) Routing only to neighbors
- 3) Information sharing at regular intervals

**19. Write the keys for understanding the link state routing.**

The three keys for understanding the algorithm are

- 1)  Knowledge about the neighborhood.

- 2) Routing to all neighbors.
- 3) Information sharing when there is a range.

## **20. How the packet cost referred in distance vector and link state routing?**

In distance vector routing, cost refer to hop count while in case of link state routing, cost is a weighted value based on a variety of factors such as security levels, traffic or the state of the link.

## **UNIT III - TRANSPORT LAYER**

### **1. What is function of transport layer?**

The protocol in the transport layer takes care in the delivery of data from one application program on one device to an application program on another device. They act as a link between the upper layer protocols and the services provided by the lower layer.

### **2. What are the duties of the transport layer?**

The services provided by the transport layer

- End-to- end delivery
- Addressing
- Reliable delivery
- Flow control
- Multiplexing

### **3. What is the difference between network layer delivery and the transport layer delivery?**

Network layer delivery

- 1) The network layer is responsible for the the source-to-destination delivery of packet
- 2) The transport layer is responsible for source-to-destination delivery of the entire message.
- 3) Transport layer delivery across multiple network links.
- 4) The transport layer is responsible for source-to-destination delivery of the entire message.

### **4. What are the four aspects related to the reliable delivery of data?**

The four aspects are, Error control, Sequence control, Loss control, Duplication control.

### **5. What is meant by segment?**

At the sending and receiving end of the transmission, TCP divides long transmissions into smaller data units and packages each into a frame called a segment.

### **6. What is meant by segmentation?**

When the size of the data unit received from the upper layer is too long for the network layer datagram or data link layer frame to handle, the transport protocol divides it into smaller usable blocks. The dividing process is called segmentation.

### **7. What is meant by Concatenation?**



The size of the data unit belonging to single sessions are so small that several can fit together into a single datagram or frame, the transport protocol combines them into a single data unit. The combining process is called concatenation.

**8. What are the types of multiplexing?**

The types of multiplexing are,  
Upward multiplexing  
Downward multiplexing

**9. What are the two possible transport services?**

Two basic types of transport services are,  
Connection service  
Connectionless services

**10. The transport layer creates the connection between source and destination. What are the three events involved in the connection?**

For security, the transport layer may create a connection between the two end ports. A connection is a single logical path between the source and destination that is associated with all packets in a message. Creating a connection involves three steps:

- 1) □ Connection establishment
- 2) Data transfer & Connection release.

**11. What is meant by congestion?**

Congestion in a network occurs if user sends data into the network at a rate greater than that allowed by network resources.

**12. Why the congestion occurs in network?**

Congestion occurs because the switches in a network have a limited buffer size to store arrived packets.

**13. What is meant by quality of service?**

The quality of service defines a set of attributes related to the performance of the connection. For each connection, the user can request a particular attribute each service class is associated with a set of attributes.

**14. What are the two categories of QoS attributes?**

The two main categories are  
User Oriented  
Network Oriented

**15. List out the user related attributes?**

User related attributes are  
SCR – Sustainable Cell Rate  
PCR – Peak Cell Rate  
MCR- Minimum Cell Rate  
CVDT – Cell Variation Delay Tolerance

**16. What are the networks related attributes?**

The network related attributes are,  
Cell loss ratio (CLR)  
Cell transfer delay (CTD)  
Cell delay variation (CDV)

Cell error ratio (CER)

**17. What are the rules of nonboundary-level masking?**

The bytes in the IP address that corresponds to 255 in the mask will be repeated in the subnetwork address.

The bytes in the IP address that corresponds to 0 in the mask will change to 0 in the subnetwork address

For other bytes, use the bit-wise AND operator.

**18. Define Gateway.**

A device used to connect two separate networks that use different communication protocols.

**19. What is LSP?**

In link state routing, a small packet containing routing information sent by a router to all other router by a packet called link state packet.

**UNIT-IV - NETWORK SECURITY**

**1. Name four factors needed for a secure network.**

Privacy: The sender and the receiver expect confidentiality.

Authentication: The receiver is sure of the sender's identity and that an imposter has not sent the message.

Integrity: The data must arrive at the receiver exactly as it was sent.

Non-Reputation: The receiver must able to prove that a received message came from a specific sender.

**2. How is a secret key different from public key?**

In secret key, the same key is used by both parties. The sender uses this key and an encryption algorithm to encrypt data; the receiver uses the same key and the corresponding decryption algorithm to decrypt the data.

In public key, there are two keys: a private key and a public key. The private key is kept by the receiver. The public key is announced to the public.

**3. What is a digital signature?**

Digital signature is a method to authenticate the sender of a message. It is similar to that of signing transactions documents when you do business with a bank. In network transactions, you can create an equivalent of an electronic or digital signature by the way you send data.

**4. What are the advantages & disadvantages of public key encryption?**

**Advantages:**

a) Remove the restriction of a shared secret key between two entities. Here each entity can create a pair of keys, keep the private one, and publicly distribute the other one.

b) The no. of keys needed is reduced tremendously. For one million users to communicate, only two million keys are needed.

**Disadvantages:**

If you use large numbers the method to be effective. Calculating the cipher text using the long keys takes a lot of time. So it is not recommended for large amounts of text.

## 5. What are the advantages & disadvantages of secret key encryption?

### Advantages:

Secret Key algorithms are efficient: it takes less time to encrypt a message. The reason is that the key is usually smaller. So it is used to encrypt or decrypt long messages.

### Disadvantages:

a) Each pair of users must have a secret key. If  $N$  people in world want to use this method, there needs to be  $N(N-1)/2$  secret keys. For one million people to communicate, a half-billion secret keys are needed.

b) The distribution of the keys between two parties can be difficult.

## 6. Define permutation.

Permutation is transposition in bit level.

Straight permutation: The no. of bits in the input and output are preserved.

Compressed permutation: The no. of bits is reduced (some of the bits are dropped).

Expanded permutation: The no. of bits is increased (some bits are repeated).

## 7. Define substitutional & transpositional encryption.

Substitutional: A character level encryption in which each character is replaced by another character in the set.

Transpositional: A Character level encryption in which the characters retain their plaintext but the position of the character changes.

## UNIT – V - APPLICATION LAYER

### 1. What is the purpose of Domain Name System?

Domain Name System can map a name to an address and conversely an address to name.

### 2. Discuss the three main division of the domain name space.

Domain name space is divided into three different sections: generic domains, country domains & inverse domain.

Generic domain: Define registered hosts according to their generic behavior, uses generic suffixes.

Country domain: Uses two characters to identify a country as the last suffix.

Inverse domain: Finds the domain name given the IP address.

### 3. Discuss the TCP connections needed in FTP.

FTP establishes two connections between the hosts. One connection is used for data transfer, the other for control information. The control connection uses very simple rules of communication. The data connection needs more complex rules due to the variety of data types transferred.

### 4. Discuss the basic model of FTP.

The client has three components: the user interface, the client control process, and the client data transfer process. The server has two components: the server control process and the server data transfer process. The control connection is made between the control processes. The data connection is made between the data transfer processes.

**5. What is the function of SMTP?**

The TCP/IP protocol supports electronic mail on the Internet is called Simple Mail Transfer (SMTP). It is a system for sending messages to other computer users based on e-mail addresses. SMTP provides mail exchange between users on the same or different computers.

**6. What is the difference between a user agent (UA) and a mail transfer agent (MTA)?**

The UA prepares the message, creates the envelope, and puts the message in the envelope. The MTA transfers the mail across the Internet.

**7. How does MIME enhance SMTP?**

MIME is a supplementary protocol that allows non-ASCII data to be sent through SMTP. MIME transforms non-ASCII data at the sender site to NVT ASCII data and delivers it to the client SMTP to be sent through the Internet. The server SMTP at the receiving side receives the NVT ASCII data and delivers it to MIME to be transform feed back to the original data.

**8. Why is an application such as POP needed for electronic messaging?**

Workstations interact with the SMTP host, which receives the mail on behalf of every host in the organization, to retrieve messages by using a client-server protocol such as Post Office Protocol, version 3(POP3). Although POP3 is used to download messages from the server, the SMTP client still needed on the desktop to forward messages from the workstation user to its SMTP mail server.

**9. Write down the three types of WWW documents.**

The documents in the WWW can be grouped into three broad categories: static, dynamic and active.

Static: Fixed-content documents that are created and stored in a server.

Dynamic: Created by web server whenever a browser requests the document.

Active: A program to be run at the client side.

**10. What is the purpose of HTML?**

HTML is a computer language for specifying the contents and format of a web document. It allows additional text to include codes that define fonts, layouts, embedded graphics and hypertext links.

**11. Define CGI.**

CGI is a standard for communication between HTTP servers and executable programs. It is used in crating dynamic documents.