

Computer Networks

III



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DESCRIPTION SHEET

COMPUTER NETWORKS

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1

Basic Concepts



Multiple Choice Questions

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Multiple Select Questions

Q.13 Which of the following are correct?

- (a) Mesh topology requires a central controller or hub.
- (b) Star topology requires a central controller or hub.
- (c) Bus topology requires a multipoint connection.
- (d) Topology in networks is the structure or pattern in which each and every node in the network is connected.

Q.14 Which of the following are correct?

- (a) In a computer network, a node can be anything that is capable of sending data or receiving data or even routing the data to its destination.
- (b) Routers, Computers and Smartphones are some examples of network nodes.
- (c) Communication channel is shared by all the machines on the network in Unicast network.
- (d) Communication channel is shared by all the machines on the network in Multicast network.

Q.15 Which of the following is correct regarding physical layer in OSI Model?

- (a) In asynchronous serial communication the physical layer provides both start and stop signalling and flow control.
- (b) In asynchronous serial communication the physical layer provides only start signalling.
- (c) The physical layer is responsible for channel coding, modulation etc.
- (d) A single channel is shared by multiple signals by multiplexing.

Q.16 Which of the following is correct?

- (a) The only difference between OSI model and TCP/IP model is that the functions of Presentation and Session layer in the OSI model are handled by the transport layer itself in TCP/IP. OSI is a generalized model and TCP/IP is an application specific model.

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- (b) Some functions of the presentation layer include character-code translation, data conversion, data encryption and decryption, and data translation.
- (c) Session layer provides the mechanism for opening, closing and managing a session between end-user application processes.
- (d) In TCP/IP protocol stack, the functions of the session layer are handled by the transport layer itself and thus the session layer is missing from the TCP/IP model.



Try Yourself

T1. Which layer does IP belong to?

- (a) Physical Layer
- (b) Data Link Layer
- (c) Network Layer
- (d) Transport Layer

[Ans: (c)]

T2. Which is not a layer in the ISO-OSI model?

- (a) Security Layer
- (b) Physical Layer
- (c) Data Link Layer
- (d) Network Layer

[Ans: (a)]

T3. Which of the following statements is true?

- I. In a well designed system, the higher layer does not have to worry about the implementation details of lower layers
 - II. A layer offers a service to the next higher layer
 - III. Two entities of the same layer handle a protocol
- Select the correct option:

- (a) Only I
- (b) I and II
- (c) I, II and III
- (d) II and III

[Ans: (c)]

T4. Which of the following is true?

- (a) Packet encapsulate frame
- (b) Datagram encapsulate packet
- (c) Frame encapsulate packet
- (d) None of the above

[Ans: (c)]

- T5. What is the technique of merging inputs of many links onto one link called?
 (a) Digitalizing (b) Multiplexing
 (c) Transmitting (d) Tunneling

[Ans: (b)]

- T6. Matching between **List-I** and **List-II**.

- List-I**
 A. Data link layer
 B. Network layer
 C. Transport layer

- List-II**
 1. Ensure reliable transport of data over a physical point to point link.
 2. Encodes/decodes data for physical transmission.
 3. Allow end to end communication between 2 processes.
 4. Routes data from one network node to the next.

Codes:

- | A | B | C |
|-------|---|---|
| (a) 1 | 4 | 3 |
| (b) 2 | 4 | 1 |
| (c) 2 | 3 | 1 |
| (d) 1 | 3 | 2 |

[Ans: (a)]

- T7. How many 8 bit characters can be transmitted per second over a 9600 baud serial communication link using asynchronous mode of transmission with time one start bit, 8 data bits, one parity bit and 2 stop bits?

[Ans: (800)]

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- T8. Protocols are
 (a) Agreements on how communication components and DTE's are to communicate
 (b) Logical communication channels used for transferring data
 (c) Physical communication channels used for transferring data
 (d) None of the above

[Ans: (a)]

- T9. Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

- List-I**
 A. Session layer
 B. Transport layer
 C. Application layer
 D. MDI (Medium Dependent Interface)

- List-II**
 1. Connects DCE into physical channel
 2. Provides end to end connectivity
 3. Provides organised means to exchange data between users
 4. Supports an end user process and perform required file transfer

Codes:

- | A | B | C | D |
|-------|---|---|---|
| (a) 3 | 4 | 2 | 1 |
| (b) 3 | 2 | 4 | 1 |
| (c) 2 | 4 | 1 | 3 |
| (d) 4 | 3 | 2 | 1 |

[Ans: (b)]



2

IPv4 Addressing



Multiple Choice Questions

Common Data for Q.1 & Q.2

A class B network address 130.50.0.0 is submitted as follows. The last 10 bits of the host id are allotted for host number and the remaining 6 bits are reserved for subnet number.

- Q.1** How many subnets and number of hosts in each subnet are possible with the above addressing scheme?

- (a) 62, 1022
- (b) 30, 510
- (c) 14, 254
- (d) None of these

- Q.2** What are the first hosts addresses of 1st and 4th subnets?

- (a) 130.50.4.1 and 130.50.16.1
- (b) 130.50.1.1 and 130.50.4.1
- (c) 130.50.0.0 and 130.50.3.0
- (d) None of these

- Q.3** Suppose an organization is assigned a block of 2048 contiguous addresses starting at address 128.211.168.0. The following figure shows the binary values of address in the range

Dotted Decimal	32-bit Binary Equivalent
Lowest 128.211.168.0	10000000 11010011 10101000 00000000
Highest 128.211.175.255	10000000 11010011 10101111 11111111

Which of the following represents the CIDR (Classless Inter-Domain Routing)

- (a) 128.211.168.0/11
- (b) 128.211.168.0/21
- (c) 128.211.175.255/11
- (d) None of these

- Q.4** Consider the following IP address corresponding subnet mask:

IP address = 172.60.50.2

Subnet mask = 255.255.224.0

Find the range of assignable IP address on the subnet on which the host belongs

- (a) 172.60.32.0 - 172.60.63.255
- (b) 172.60.32.1 - 172.60.63.254
- (c) 172.60.32.1 - 172.60.64.255
- (d) 172.60.32.0 - 172.60.127.254

- Q.5** A host is connected to a department network which is part of a university network. The university network is part of the Internet. The largest network in which the ethernet address of the host is unique is

- (a) The subnet to which the host belongs
- (b) The department network
- (c) The university network
- (d) The internet

[GATE IT-2004]

- Q.6** An organization has a class C network and wants to form, subnet for four departments with hosts as follows:

- | | |
|--------------|--------------|
| A. 72 | B. 35 |
| C. 20 | D. 18 |

What are the possible arrangements of subnets?

- (a) For A-255.255.255.128;
For B-255.255.255.192;
For C & D-255.255.255.224
- (b) For A-255.255.255.224;
For B-255.255.255.192;
For C & D -255.255.255.128

- (c) For A-255.255.255.192;
For B - 255.255.255.128;
For C & D - 255.255.255.224
 - (d) For A-255.255.255.224;
B & C & D - 255.255.255.224
- Q.7** A subnetted Class B network has the following broadcast address: 144.16.95.255. Its subnet mask
- (a) is necessarily 255.255.224.0
 - (b) is necessarily 255.255.240.0
 - (c) is necessarily 255.255.248.0
 - (d) could be one of 255.255.224.0, 255.255.240.0, 255.255.248.0
- [GATE IT-2006]**
- Q.8** An organization has a class B network and wishes to form subnets for 64 departments. The subnet mask would be
- (a) 255.255.0.0 (b) 255.255.64.0
 - (c) 255.255.128.0 (d) 255.255.252.0
- [GATE-2005]**
- Q.9** The address of a class B host is to be split into subnets with a 6-bit subnet number. What is the maximum number of subnets and the maximum number of hosts in each subnet?
- (a) 62 subnets and 262142 hosts
 - (b) 64 subnets and 262142 hosts
 - (c) 62 subnets and 1022 hosts
 - (d) 64 subnets and 1024 hosts
- [GATE-2007]**
- Q.10** The routine table of a router is shown below:

Destination	Subnet Mask	Interface
132.81.0.0	255.255.0.0	eth0
132.81.64.0	255.255.224.0	eth1
132.81.68.0	255.255.255.0	eth2
132.81.68.64	255.255.255.224	eth3

A packet bearing a destination address 132.81.68.132 arrives at the router. On which interface will it can not be forwarded?

- (a) Eth0 (b) Eth1
- (c) Eth2 (d) Eth3

[DRDO-2008]

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- Q.11** Which of the following statements is/are TRUE about IP address.
- P : IP address 128.128.255.255 is used for broadcasting on class B network
- Q : IP address 127.127.255.255 is used for loopback testing.
- (a) P only
 - (b) Q only
 - (c) Both P and Q
 - (d) Neither P nor Q
- [DRDO-2008]**
- Q.12** Which of the following is a MAC address?
- (a) 192.166.200.50
 - (b) 00056A : 01A5CCA7FF60
 - (c) 568.Airport Road
 - (d) 01 : A5 : BB : A7 : FF : 60
- [GATE-2003]**
- Q.13** The subnet mask for a particular network is 255.255.31.0 which of the following pairs of IP addresses could belong to this network?
- (a) 172.57.88.62 and 172.56.87.23
 - (b) 10.35.28.2 and 10.35.29.4
 - (c) 191.203.31.87 and 191.234.31.88
 - (d) 128.8.129.43 and 128.8.161.55
- [ISRO-2009]**
- Q.14** Convert IP address whose hexadecimal representation in C22F1582 to dotted
- (a) 194.47.21.130
 - (b) 194.47.15.130
 - (c) 194.47.21.82
 - (d) None of these
- Q.15** Suppose computers A and B have IP addresses 10.105.1.113 and 10.105.1.91 respectively and they both use the same netmask N. Which of the values of N given below should not be used if A and B should belong to the same network?
- (a) 255.255.255.0
 - (b) 255.255.255.128
 - (c) 255.255.255.192
 - (d) 255.255.255.224
- [GATE-2010]**

2
3
6
9

Numerical Answer Type Questions

Q.16 A host in a subnet has the IP address 130.83.126.10. How many hosts can be addressed in network?

Q.17 If a class B network on the Internet has a subnet mask of 255.255.248.0, what is the maximum number of hosts per subnet?

[GATE-2008]

Linked Data Questions (Q.18 & Q.19)

Q.18 The Internet host is roughly doubling in size every 18 months. Although no one really knows for sure, one estimate put the number of hosts on it at 7 million in January 1996. Using these data the expected number of internet hosts in the January 2008 is (in billion).

Q.19 In order to connect these numbers of hosts the minimum number of networks required in class A is _____.



Multiple Select Questions

Q.20 Four hosts (H_1, H_2, H_3 and H_4) are connected to one active hub.

H_1 's IP address is 192.168.7.33/24

H_2 's IP address is 192.168.7.7/16

H_3 's IP address is 192.168.7.43/24

H_4 's IP address is 192.1.168.7./28

Which of following pairs that can ping each other?

- (a) $H_1 - H_2$
- (b) $H_1 - H_3$
- (c) $H_2 - H_3$
- (d) $H_2 - H_4$

Q.21 Loop back addresses

- (a) 127.X.X.X
- (b) Test the software on the machine without really having physical network.
- (c) Class A type addresses.
- (d) Can be used as a destination address only.

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Q.22 If the broadcast address of the subnet is given as 163.93.63.255. Which of the following mask suit the above address?

- (a) 255.255.240.0
- (b) 255.255.248.0
- (c) 255.255.128.0
- (d) 255.255.192.0

Q.23 $IP_1 = 201.15.16.19$

Subnet mask = 255.255.255.224

Which of following can be possible subnet ID?

- (a) 201.15.16.96
- (b) 201.15.16.48
- (c) 201.15.16.64
- (d) 201.15.16.78

Q.24 Which of following can be first address of block if block contains 16 IP addresses?

- (a) 201.16.16.8
- (b) 201.16.16.48
- (c) 201.16.16.160
- (d) 201.16.16.24

Q.25 Which of following is true in case of supernetting?

- (a) It will divide network into small parts.
- (b) Join two or more networks to form a large network.
- (c) During this process, some of network bits of 1's will convert to 0's of supernet.
- (d) None of these

Q.26 Which of following can be last host of a subnet if subnet mask is 255.255.255.240?

- (a) 200.15.14.15
- (b) 200.15.14.48
- (c) 200.15.14.14
- (d) 200.15.14.30

Q.27 Which of following can be first address of block if block contains 65536 address?

- (a) 16.16.16.0
- (b) 18.18.0.0
- (c) 19.18.0.5
- (d) 19.13.0.0



Try Yourself

T1. Match the following:

List-I (Packets)

	Source IP	Destination IP
A.	Data 250.255.255.255	40.40.40.40
B.	Data 22.21.23.24	255.255.255.255
C.	Data 24.23.22.21	24.22.23.24

List-II

1. Unicast packet within network
2. This packet never exists
3. Limited broadcasting

Codes:

A	B	C
(a) 1	2	3
(b) 2	3	1
(c) 3	1	2
(d) 2	1	3

[Ans: (b)]

T2. The direct broadcast address of the IP address 205.18.136.187 with subnet Mask 255.255.255.240 is
 (a) 205.18.136.187 (b) 205.18.255.255
 (c) 205.18.136.255 (d) 205.18.136.191

[Ans: (d)]

T3. Consider the following routing table at an IP router:

Network No.	Net Mask	Next Hop
128.96.170.0	255.255.254.0	Interface 0
128.96.168.0	255.255.254.0	Interface 1
128.96.166.0	255.255.254.0	R2
128.96.164.0	255.255.252.0	R3
0.0.0.0	Default	R4

For each IP address in **List-I** identify the correct choice of the next hop from **List-II** using the entries from the routing table above.

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List-I

- A. 128.96.171.92
- B. 128.96.167.151
- C. 128.96.163.121
- D. 128.96.165.121

Codes:

A	B	C	D
(a) 1	3	5	4
(b) 1	4	2	5
(c) 2	3	4	5
(d) 2	3	5	4

[Ans: (a)]

T4. Suppose computers A and B have IP addresses 10.105.1.113 and 10.105.1.91 respectively and they both use the same network N. Which of the values of N given below should not be used if A and B should belong to the same network?
 (a) 255.255.255.0
 (b) 255.255.255.128
 (c) 255.255.255.192
 (d) 255.255.255.224

[Ans: (d)]

T5. In the IPV₄ addressing format, the number of networks allowed under class C addresses is
 (a) 2^{14} (b) 2^7
 (c) 2^{21} (d) 2^{24}

[Ans: (c)]

T6. An internet service provider (ISP) has the following chunk of CIDR-based IP addresses available with it 245.248.128.0/20. The ISP wants to give half of this chunk of addresses to organisation A, and a quarter of organisation B, while retaining the remaining with itself which of the following is a valid allocation of addresses to A and B?
 (a) 245.248.136.0/21 and 245.248.128.0/22
 (b) 245.248.128.0/21 and 245.248.128.0/22
 (c) 245.248.132.0/22 and 245.248.132.0/21
 (d) 245.248.136.0/24 and 245.248.132.0/21

[Ans: (a)]

- T7. An IP router implementing CIDR services a packet with address 131.23.151.76. The routers routing table has the following entries:

Prefix	Output Interface identifier
131.16.0.0/12	3
131.28.0.0/14	5
131.19.0.0/16	2
131.22.0.0/15	1

The identifier of the output interface on which this packet will be forwarded is _____.

[Ans: (1)]

- T8. These are 3 IP addresses as given below:

$$X = 202.23.14.150$$

$$Y = 168.19.200.12$$

$$Z = 72.192.52.210$$

Which of the following statements is correct?

- (a) X is class A, Y is class B, Z is class C
- (b) X is class C, Y is class A, Z is class B
- (c) X is class C, Y is class B, Z is class A
- (d) X is class A, Y is class C, Z is class B

[Ans: (c)]

- T9. Given an IP address 156.233.42.56 with subnet mask of 7 bits. How many hosts and subnets are possible?

- (a) 126 hosts, 510 subnets
- (b) 128 hosts, 512 subnets
- (c) 510 hosts, 126 subnets
- (d) 512 hosts, 128 subnets

[Ans: (c)]

- T10. Which of the following is a valid IP address assigned to host?

- (a) 127.0.0.1
- (b) 192.248.16.255
- (c) 25.5.25.55
- (d) 150.7.0.0

[Ans: (c)]



3

Data Link Layer



Multiple Choice Questions

- Q.1** Probability of frame reaching safely is “ Q ” then mean number of transmission of a frame is
- (a) $\frac{1}{(1-Q)}$
 - (b) $\frac{1}{Q}$
 - (c) $Q + 1$
 - (d) $\frac{1}{1+Q}$
- Q.2** Go-Back-N ARQ supports
- (a) Individual Acks
 - (b) Cumulative Acks
 - (c) Both (a) and (b)
 - (d) None of these
- Q.3** Which of following does not require acknowledgment to be send by receiver?
- (a) Error detection code
 - (b) Error correction code
 - (c) Both (a) and (b)
 - (d) None of these
- Q.4** Which error detection method consists of a parity bit for each data unit as well as an entire data unit of parity bits?
- (a) Simply parity check
 - (b) Two-dimensional parity check
 - (c) CRC
 - (d) Checksum

Common Data for Q.5 & Q.6

A 3000 km long trunk is used to transmit frames using a Go-Back -N protocol. The propagation speed is $6 \mu\text{sec}/\text{km}$ and truck data rate is 1.544 Mbps. We ignore the transmission time taken to receive the bits in the acknowledgment. Frame size is 64 bytes.

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- Q.5** If Go-Back-N protocol is used, what is the maximum window size at the sender's side?
- (a) 32
 - (b) 63
 - (c) 109
 - (d) 219

- Q.6** What is the maximum number of bits of the sequence number?
- (a) 5
 - (b) 6
 - (c) 7
 - (d) 8

Common Data for Q.7 & Q.8

Two peer processes A(sender) and B(receiver) use stop-and-wait ARQ to send packets over a single link with capacity C. All packets have the same length of 100 bits. The round-trip time (which is the time until A receives an acknowledgment for a sent packet) is equal to 2 seconds. Assume that no packets or ACK's are dropped and that all packets and ACK's arrive error-free. Furthermore, assume that the capacity C is equal to 100,000 bits per second.

- Q.7** Find the average (transmission) rate (in bits per seconds) with which process A sends data to process B?
- (a) 34.47 bps
 - (b) 49.97 bps
 - (c) 51.45 bps
 - (d) 67.75 bps

- Q.8** What is the link utilization?

- (a) 0.0005
- (b) 0.0002
- (c) 0.0001
- (d) 0.0050

- Q.9 Assertion (A):** Data link protocols almost always put the CRC in a trailer rather than in a header.
Reason (R): The CRC is computed during transmission and appended to the output stream as soon as the last bit goes out.

- (a) Both [A] and [R] are true and [R] is the correct reason for [A]

(b) Both [A] and [R] are true but [R] is not the correct reason for [A]

(c) Both [A] and [R] are false

(d) [A] is true but [R] is false

Q.10 Receiver window size is one in stop and wait ARQ, GoBackN ARQ indicates

(a) It accepts out of order frames

(b) It accepts in order frames only

(c) It will not accept data

(d) None of these

Common Data for Q.11 & Q.12

Given the generator function $G(x)$ and the message function $M(x)$ as follows:

$$G(x) = x^4 + x + 1$$

$$M(x) = x^7 + x^6 + x^4 + x^2 + x$$

- Q.11** Calculate the transmission function $T(x)$

 - $x^{11} + x^7 + x^5 + x^4 + x^3 + x$
 - $x^{11} + x^{10} + x^8 + x^6 + x^5 + x^2 + x$
 - $x^{10} + x^7 + x^6 + x^2 + x$
 - $x^{11} + x^{10} + x^8 + x^6 + x^5$

- Q.12** Consider the transmission is damaged such that the receiver receives

$$R(x) = x^{11} + x^9 + x^8 + x^7 + x^3 + x^2 + x + 1$$

Then how many bits differ?

- Q.13** The distance between two stations M and N is L kilometers. All frames are K bits long. The propagation delay per kilometer is t seconds. Let R bits/second be the channel capacity. Assuming that processing delay is negligible, the minimum number of bits for the sequence number field in a frame for maximum utilization when the sliding window protocol is used, is

- (a) $\left\lceil \log_2 \frac{2LtR + 2K}{K} \right\rceil$ (b) $\left\lceil \log_2 \frac{2LtR}{K} \right\rceil$
 (c) $\left\lceil \log_2 \frac{2LtR + K}{K} \right\rceil$ (d) $\left\lceil \log_2 \frac{2LtR + K}{2K} \right\rceil$

[GATE-2007]

Assume that the acknowledgment packets are negligible in size and there are no errors during communication.

[DRDO-2008]

Q.21 Two ground stations are connected by a 10 Mbps satellite link. The altitude of the satellite is 36,000 km and the speed of the signal is 3×10^8 m/sec. What should be the packet size for channel utilization of 50% using go-back-N sliding window protocol. Window size is 100. Assume that the acknowledgment packets are negligible in size and there are no errors during communications.

- (a) 1.5 Kbytes (b) 3 Kbytes
 (c) 4.5 Kbytes (d) 6 Kbytes

[DRDO-2008]

Q.22 Match the following:

List-I

- I. Gateway
 - II. Switch
 - III. Router
 - IV. Hub

List-II

- P. Physical layer
 - Q. Data link layer
 - R. Network layer
 - S. Transport layer

(a) I - S, II - P, III - R, IV - Q

(b) I - **S**, II - R, III - Q, IV - P

(c) I - R, II - Q, III - S, IV - P

(d) I - S, II - Q, III - R, IV - P

[DRDO-2008]

Q.23 Sliding Window Protocol with Selective reject/reject gives better performance than other protocols when

- (a) buffer is sufficient and bandwidth is limited
 - (b) buffer is moderate and bandwidth is sufficient
 - (c) buffer is moderate and bandwidth is limited
 - (d) buffer is sufficient and bandwidth is sufficient

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Numerical Answer Type Questions

Q.24 A selective repeat ARQ is using 7 bits to represent the sequence numbers. What is the maximum size of the window?

Q.25 Calculate the link utilization (in %) for stop and wait flow control mechanisms, if the frame size is 5000 bits, bit rate is 9000 bps and distance between device is 2000 km. Speed of propagation over the transmission media is 200,000 Km per second.

Q.26 Station A uses 32 bytes packets to transmit message to station B using a sliding window protocol. The round trip delay between A and B is 80 milliseconds and the bottleneck bandwidth on the path between A and B is 128 Kbps. What is the optimal window size that A should use?

[GATE-2006]

Q.27 If a binary signal is sent over a 3-kHz channel whose signal to noise ratio is 20 dB. What is maximum achievable data rate (in Kbits/sec)?

Q.28 A channel has a bit rate of 4 kbps and one-way propagation delay of 20 ms. The channel uses stop and wait protocol. The transmission time of the acknowledgment frame is negligible. To get a link utilization of at least 50%, the minimum frame size should be bits.

[GATE IT-2005]

Q.29 An error correcting code has the following code words: 00000000, 00001111, 01010101, 10101010, 11110000. What is the maximum number of bit errors that can be corrected?

[GATE IT-2007]

Q.30 What is the channel capacity of printer (in bps) with a 400 Hz bandwidth and a signal-to-noise ratio is 7 dB?



Multiple Select Questions

Q.31 Assume 10 nodes are connected to a 1000 meter length of coaxial cable. Using some protocol each node can transmit 500 frames/second. The average frame length is 2600 bits and transmission rate of each node of 104 Mbps. Which of the following are correct?

- (a) The throughput of the system is 5000 frames/sec.
- (b) The efficiency of the system is 12.5%.
- (c) The maximum system rate of the system is 4000 frames/sec.
- (d) None of these

Q.32 Consider the following statement which of the following are correct?

- (a) A static table is more flexible than a dynamic table in responding to both error and congestion conditions.
- (b) The minimum hamming distance required to detect d errors is $d + 1$.
- (c) The minimum hamming distance required to correct d error is $2d + 1$.
- (d) The minimum hamming distance required to detect d errors is $d - 1$.

Q.33 Which of the following statements are correct?

- (a) Media Access Control sublayer of the data link layer performs data link functions that depend upon the type of medium as well as to overcome the collisions.
- (b) Piggybacking is a technique of temporarily delaying outgoing acknowledgments so that they can hook onto the next outgoing data frame.
- (c) Transport layer aggregates data from different locations into a single stream before passing it to data link layer.
- (d) The packet of information at the application layer is called segment.

Q.34 4 bit sequence number is used in Go-back-N ARQ. The allowable frames that can be transmitted by the sender are

- (a) 16
- (b) 32
- (c) 15
- (d) 7

Q.35 5 bit sequence number are used in Go-back-N ARQ. The possible outstanding frames as you get the acknowledgment to sender are

- (a) 31
- (b) 32
- (c) 16
- (d) 19

Q.36 Window size calculation in shielding window protocols depends on

- (a) Bandwidth
- (b) RTT
- (c) Hop
- (d) None of these

Q.37 Given data = 11011 and CRC generator = 1101, then the possible syndrome at receiver to say that there is an error in codeword received

- (a) 000
- (b) 1101
- (c) 101
- (d) 001

Q.38 Which of the following is false with respect to error control policies?

- (a) The efficiency of any error detection scheme decreases as the length of data increases.
- (b) The efficiency of any error detection scheme increases as the length of data increases.
- (c) Error detection policy will tell there is an error but it will not tell which bit has an error.
- (d) Error detection policy will tell which bit has an error.



Try Yourself

- T1.** Consider a network connecting two systems located 8000 kilometers apart. The bandwidth of the network is 500×10^6 bits per second. The propagation speed of the media is 4×10^8 meters per second. It is needed to design a Go-Back-N sliding window protocol for this network. The average packet size is 10^7 bits. The network is to be used to its full capacity.

Assume that processing delays at nodes are negligible. Then, the minimum size in bits of the sequence number field has to be _____.

[GATE-2015, Ans: (8)]

- T2. Bandwidth of a link is 1000 Mbps and round trip time is given as 250 μ sec. If frame size is 500 bits, calculate the link utilization (in percentage) of channel when STOP and WAIT ARQ is used.

[Ans: (0.2)]

- T3. The message 11001001 is to be transmitted using CRC polynomial x^3+1 to protect it from errors. The message that should be transmitted is:
(a) 11001001000 (b) 11001001011
(c) 11001010 (d) 110010010011

[Ans: (b)]

- T4. Let $G(x)$ be the generator polynomial used for CRC checking. What is the condition that should be satisfied by $G(x)$ to detect odd number of bits of error?
(a) $G(x)$ contains more than two terms
(b) $G(x)$ does not divide $1 + x^k$, for any k not exceeding the frame length
(c) $1 + x$ is a factor of $G(x)$
(d) $G(x)$ has an odd number of terms

[Ans: (c)]

T5. A bit stuffing based framing protocol uses an 8 bit delimiter pattern of 01111110. If the output bit string after stuffing is 01111100101, then the input bit string

- (a) 0111110100 (b) 0111110101
(c) 0111111101 (d) 0111111111

[Ans: (b)]

- T6. Consider a 128×10^3 bits/second satellite communication link with one way propagation delay of 150 milliseconds. Selective retransmission (repeat) protocol is used on this link to send data with a frame size of 1 kilobyte. Neglect the transmission time of acknowledgement. The minimum number of bits required for the sequence number field to achieve 100% utilization is _____.

[GATE-2016, Ans: (4)]

- T7. A sender uses the Stop-and-Wait ARQ protocol for reliable transmission of frames. Frames are of size 1000 bytes and the transmission rate at the sender is 80 Kbps (1 Kbps = 1000 bits/second). Size of an acknowledgment is 100 bytes and the transmission rate at the receiver is 8 Kbps. The one-way propagation delay is 100 milliseconds. Assuming no frame is lost, the sender throughput is _____ bytes/second.

[GATE-2016, Ans: (2500)]



MAC-Sublayer



Multiple Choice Questions

[GATE IT-2005]

 Q.4 Match the following:

List-I

- I. 802.3
 - II. 802.11
 - III. 802.15
 - IV. 802.16

List-II

P. Wireless

Q. Bluetooth

- R.** Ethernet
S. Wireless MAN

(a) I - R, II - P, III - Q, IV - S
(b) I - S, II - R, III - Q, IV - P
(c) I - R, II - Q, III - S, IV - P
(d) I - S, II - Q, III - R, IV - P

[DRDO-2008]

- Q.5** “L” is length of standard ethernet. What would be the length of gigabit ethernet in order to maintain same frame size of standard ethernet.

- (a) $\left(\frac{L}{10}\right)$ (b) $\left(\frac{L}{100}\right)$
 (c) $\left(\frac{L}{1000}\right)$ (d) $10L$

- Q.6** Hidden node problem is solved by
(a) CSMA/CD (b) CSMA/CA
(c) CSMA (d) None of these

- Q.7** The minimum and maximum size of the payload in Ethernet frame is

 - (a) 0-1526
 - (b) 46-1526
 - (c) 46-1500
 - (d) 72-1500

**2 3
6 9****Numerical Answer Type
Questions**

- Q.8 Consider building a CSMA/CD network running at 10 Mbps over a cable with no repeaters. If the signal speed in the cable is 10^6 km/sec and minimum frame size is 1500 bytes then what is the cable length (in km)?

- Q.9 The maximum throughput of slotted aloha is _____.

- Q.10 A group of N stations share 50 Kbps slotted ALOHA channel. Each station outputs a 500 bits frame on an average of once 5000 ms, even if previous one has not been sent. What is the maximum value of N?

- Q.11 A certain population of ALOHA users manages to generate 70 request/sec. If the time is slotted in units of 50 msec, then channel load would be

- Q.12 Consider a simplified time slotted MAC protocol, where each host always has data to send and transmits with probability $p = 0.2$ in every slot. There is no backoff and one frame can be transmitted in one slot. If more than one host transmits in the same slot, then the transmissions are unsuccessfully due to collision.

What is the maximum number of hosts which this protocol can support, if each host has to be provided a minimum throughput of 0.16 frames per time slot?

[GATE IT-2004]

- Q.13 In a TDM medium access control bus LAN, each station is assigned one time slot per cycle for transmission. Assume that the length of each time slot is the time to transmit 100 bits plus the end-to-end propagation delay. Assume a propagation speed of 2×10^8 m/sec. The length of the LAN is 1 km with a bandwidth of 10 Mbps. The maximum number of stations that can be allowed in the LAN so that the throughput of each station can be $2/3$ Mbps is _____.

[GATE IT-2005]

- Q.14 The round trip propagation delay for a 100 Mbps Ethernet having 48-bit jamming signal is 64 ms. What is the minimum frame size (in bytes)?

[DRDO-2008]

**Multiple Select Questions**

- Q.15 Probability of frame reaching safely is 0.1 then which of following is true.

- (a) Mean number of transmission of a frame is 10.
- (b) Probability of frame not reaching safely is 0.9.
- (c) It is an efficient channel.
- (d) None of these

- Q.16 Which of following is true with respect to DCF and PCF functions?

- (a) When a node wants to transmit data to the access node, DCF function is used.
- (b) When access node wants to transmit data to the node PCF function is used.
- (c) In wireless, CSMA/CD is used for communication.
- (d) None of these

- Q.17 Which of following is true in case of CSMA/CD protocol. If "l" is length of cable is preferred in standard ethernet and "x" is the minimum frame size maintained.

- (a) In order to maintain same frame size of standard ethernet, in case of switched ethernet (100 base T) then the length of cable

is $\left(\frac{l}{10}\right)$.

- (b) In order to maintain same frame size of standard ethernet in case of giga bit ethernet (1000 base T) then the length of cable is

$\left(\frac{l}{100}\right)$.

- (c) In all different models of ethernet, "I" is always constant to maintain same frame size.
- (d) None of these

Q.18 Which of following is true in case of wireless network?

- (a) DCF is having high priority over PCF.
- (b) PCF is having high protocol over DCF.
- (c) Exponential back off algorithm is applied when both stations send RTS at the same time after collision.
- (d) None of these



Try Yourself

T1. Consider two machines, A and B, connected by a 100 Mbps ethernet with three store and forward relay switches in path between them. Suppose that no other machines are using the ethernet, that each of the link introduces a propagation delay of $12 \mu\text{s}$, and that switch begins transmitting a packet immediately after receiving the last bit of the packet. What is the total transfer time for a 1500 bytes packet, as measured from transmission of the first bit from A to the receipt of last bit at B?

[Ans: (528)]

T2. In P-persistent CSMA network there are 5 systems in a slot. The probability of station not transmitting the data is 0.6. Only two stations should transmit the data to avoid collision. What is the probability that channel is collision free?

[Ans: (0.3456)]

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T3. Determine the maximum length of the cable (in km) for transmitting data at a rate of 100 Mbps in Ethernet LAN with frame size of 1000 bits. Assume signal speed as $2 \times 10^5 \text{ km/sec}$.

[Ans: (1)]

T4. A 4 Mbps token ring has a token holding time value of 10 ms. What is the longest frame that can be sent on this ring? (in bits)

[Ans: (40000)]

T5. What is the minimum frame size in (bits) CSMA/CD, if 100 base 5 cable is used? (Assume velocity of data = $2 \times 10^8 \text{ m/s}$)

[Ans: (500)]

T6. A network has a data transmission bandwidth of $20 \times 10^6 \text{ bits per second}$. It uses CSMA/CD in the MAC layer. The maximum signal propagation time from one node to another node is 40 microseconds. The minimum size of a frame in the network is _____ bytes.

[GATE-2016, Ans: (200)]

T7. In an Ethernet local area network, which one of the following statements is **TRUE**?

- (a) A station stops to sense the channel once it starts transmitting a frame.
- (b) The purpose of the jamming signal is to pad the frames that are smaller than the minimum frame size.
- (c) A station continues to transmit the packet even after the collision is detected.
- (d) The exponential backoff mechanism reduces the probability of collision on retransmissions.

[GATE-2016, Ans: (d)]



5

Network Layer

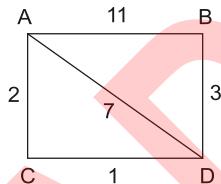


Multiple Choice Questions

- Q.1** Which of following is the fast convergence algorithm?
 (a) Distance vector routing
 (b) Link state routing
 (c) Both (a) and (b)
 (d) None of these

- Q.2** Periodic timer is used to know
 (a) Status of router (b) Status of link
 (c) Both (a) and (b) (d) None of these

- Q.3** Consider the following network.



Using distance vector routing, the distance to B that A will store initially in its routing table is _____ and once the routes have been converged, the distance to B that A will store in its routing table is _____?

- (a) 6 and 6 respectively
 (b) 6 and 11 respectively
 (c) 11 and 6 respectively
 (d) 11 and 11 respectively

- Q.4** Trigger update in routing algorithms is used for
 (a) Status of router
 (b) Status of link
 (c) Change of topology
 (d) Both (b) or (c)

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- Q.5** Distance vector with split horizon defines
 (a) Sent the route information back to node which learned from it as infinity.
 (b) Do not send the route information back to node which learned from it.
 (c) Same as distance vector
 (d) None of these
- Q.6** A router has two full-duplex Ethernet interfaces each operating at 100 Mbps. Ethernet frames are at least 84 bytes long (including the Preamble and the Inter-Packet-Gap). The maximum packet processing time at the router for wire speed forwarding to be possible is (in micro seconds)
 (a) 0.01 (b) 3.36
 (c) 6.72 (d) 8

[GATE IT-2006]

- Q.7** Estimated costs converging towards final costs in routing algorithm then
 (a) Estimated costs links will be used
 (b) Estimated costs links will be unused
 (c) No change in link
 (d) None of these
- Q.8** Consider 4 networks 199.202.0.0, 199.202.1.0, 199.202.2.0, 199.202.3.0 and perform CIDR aggregation to select one of the following supernet mask
 (a) 255.255.252.0
 (b) 255.255.255.252
 (c) 255.255.252.255
 (d) 255.255.252.252

Q.9 The routing table of a router is shown below:

Destination	Subnet Mask	Interface
128.75.43.0	255.255.255.0	Eth0
128.75.43.0	255.255.255.128	Eth1
192.12.17.5	255.255.255.255	Eth3
Default		Eth2

On which interface will the router forward packets addressed to destinations 128.75.43.16 and 192.12.17.10 respectively?

- (a) Eth1 and Eth2 (b) Eth0 and Eth2
- (c) Eth0 and Eth3 (d) Eth1 and Eth3

Q.10 Two popular routing algorithms are Distance Vector (DV) and Link State (LS) routing. Which of the following are true?

- S₁**: Count to infinity is a problem only with DV and not LS routing.
 - S₂**: In LS, the shortest path algorithm is run only at one node.
 - S₃**: In DV, the shortest path algorithm is run only at one node.
 - S₄**: DV requires lesser number of network messages than LS.
- (a) S₁, S₂ and S₄ only (b) S₁, S₃ and S₄ only
 - (c) S₂ and S₃ only (d) S₁ and S₄ only

[GATE IT-2008]

Q.11 Two consecutive fragment offset values can be helpful to known

- (a) Size of fragment (b) Size of segment
- (c) Size of frame (d) None of these

Linked Answer for Q.12 & Q.13

Q.12 Suppose an x -bit message was send over a k -hop path in a circuit switched network. The circuit setup time is ' s ' seconds; the propagation delay is d seconds per hop. The packet size is p bits, and the data rate is b bps. At what time, the message arrives at the receiver side?

- (a) $t = s(k - 1) + \frac{x}{b}$ (b) $t = s + kd + b$
- (c) $t = s + \frac{x}{b} + kd$ (d) $t = \frac{x}{b}$

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Q.13 Suppose, the message was sent in a lightly loaded packet switched network with the above said properties and $s > (k - 1)p/b$ we can conclude that,

- (a) Circuit switching is faster than packet switching.
- (b) Packet switching is faster than circuit switching.
- (c) Both packet and circuits switching are transmitting at the same rate.
- (d) None of the above

Q.14 One of the header fields in an IP datagram is the Time-to-Live (TTL) field. Which of the following statements best explain the need for this field?

- (a) It can be used to prioritize packets
- (b) It can be used to reduce delays
- (c) It can be used to optimize throughput
- (d) it can be used to prevent packet looping

[GATE-2010]

Q.15 Which network forwards packet according to host destination address?

- (a) Circuit switched, networks
- (b) Both datagram and virtual circuit networks
- (c) Datagram networks
- (d) Virtual circuit networks

Q.16 Which of the following is a list of packet switching characteristics?

- (a) Bandwidth divided, translation tables for routing, destination address.
- (b) Bandwidth shared, queues at router, different path possible.
- (c) Bandwidth divided, store and forward, good for bursty data.
- (d) Bandwidth shared, low transmission delay, routes may change.

Q.17 Resource reservation is a feature of

- (a) Both packet switching and circuit switching
- (b) Circuit switching
- (c) Packet switching
- (d) None of these

- Q.18** What information is used by a process running on one host to identify a process on another host?

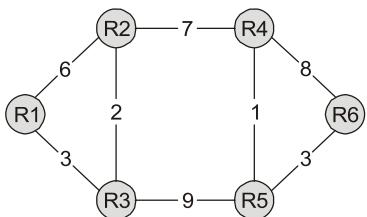
 - (a) IP address
 - (b) Process ID
 - (c) Process descriptions
 - (d) Port number

- Q.19** Which one of following fields of an IP header is not modified by typical IP router?

 - (a) Checksum
 - (b) Source address
 - (c) Time to live
 - (d) Length

Linked Answer for Q.20 & Q.21

Consider a network with 6 routers R1 to R6 connected with links having weights as shown in the following diagram.



- Q.20** All the routers use the distance vector based routing algorithm to update their routing tables. Each router starts with its routing table initialized to contain an entry for each neighbour with the weight of the respective connecting link. After all the routing tables stabilize, how many links in the network will never be used for carrying any data?

(a) 4 (b) 3
(c) 2 (d) 1

- Q.22** Consider three statements about link state and distance vector routing protocols for a large network with 500 network nodes and 4000 links.

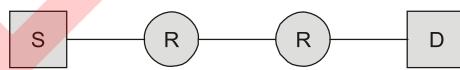
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- S₁:** The computational overhead in link state protocols is higher than distance vector protocols.
 - S₂:** A distance vector protocol (with split horizon) avoids persistent routing loops, but not a link state protocol.
 - S₃:** After a topology change, a link state protocol will converge faster than a distance vector protocol.

Which one of the following is correct about S_1 , S_2 and S_3 ?

- (a) S_1, S_2, S_3 all are true
 (b) S_1, S_2, S_3 all are false
 (c) S_1, S_2 are true but S_3 is false
 (d) S_1, S_3 are true but S_2 is false

- Q.23** Assume source S and destination D are connected through two intermediate routers labeled R. Determine how many times each packet has to visit the network layer and data link layer from S to D.



- (a) Network layer-4 times, data link layer-4 times
 - (b) Network layer-4 times, data link layer-3 times
 - (c) Network layer-4 times, data link layer-6 times
 - (d) Network layer-2 times, data link layer-6 times



Multiple Select Questions

- Q.24** Consider the following statements and select the correct options.

 - (a) An ethernet switch maintain a mapping of IP address to MAC address.
 - (b) An end host maintain a mapping of IP address of MAC address.
 - (c) Distance vector routing requires a map of the complete topology.
 - (d) Link state routing requires a map of the complete topology.

Q.25 Which of the following are correct?

- (a) An ARP request is normally broadcast and ARP response is normally unicast.
- (b) An ICMP error message may be generated only for the first fragment.
- (c) RARP is a dynamic mapping protocol in which a physical is found for a given logical address.
- (d) IGMP is a multicasting routing protocol.

Q.26 Consider the following statements with respect to routing protocols and select the correct answer.

- (a) OSPF is an intra-domain routing protocol based on distance vector routing.
- (b) Link state routing uses Dijkstra's algorithm to build routing tables.
- (c) In distance vector routing each node periodically share its routing table with every other node in the network and whenever there is a change.
- (d) Distance vector is an intra domain routing protocol whereas path vector is an inter domain routing protocol.

Q.27 Which of the following statements are correct?

- (a) DHCP (Dynamic Host Configuration Protocol) provides URL (Universal Resource Locator) to the client.
- (b) IP assigned for a client by DHCP server is for a limited period or for a permanent period.
- (c) DHCP client and servers on the same subnet communicate via UDP broadcast.
- (d) The DHCP server maintains the information about client configuration parameters.

Q.28 Which of following is false in case of ICMP protocol?

- (a) It is used for the reporting errors.
- (b) Parameter problem message will be transmitted whenever the packet is in loop.
- (c) Source quench message is transmitted whenever fragmentation is required for packet.

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(d) Time exceeded message is transmitted when the packet is in loop.

Q.29 Which of following is false with respect to routing algorithms?

- (a) Purpose of periodic timer is to know the status of link.
- (b) Purpose of trigger update is to know the status of router.
- (c) Flooding is a dynamic algorithm to find a route for a packet.
- (d) Count to infinity is a problem with routing tables filled with wrong values.

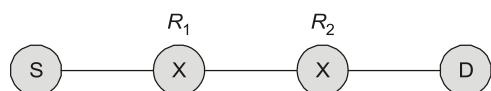
Q.30 Which of following is true with respect to IP protocol in the network layer?

- (a) HLEN = 0100 is a valid header.
- (b) Identification number = 70000 is a valid identification number for a packet.
- (c) DF = 1 is do not fragment bit for a packet.
- (d) DF = 0, MF = 0 indicates that it is a last fragment of that packet.

Q.31 Which of following is true respect to protocols?

- (a) ARP protocol is to get destination IP address.
- (b) RARP protocol is to get destination IP address.
- (c) RARP protocol is to get destination MAC address.
- (d) ARP protocol is to get destination MAC address.

Q.32 Which of following is true in below diagram?



- (a) Number of times data link layer visited from S to D is 6.
- (b) Number of times network layer visited from S to D is 4.
- (c) Number of times data link layer visited from S to D is 4.
- (d) Number of times network layer visited from S to D is 6.



Try Yourself

- T1.** Which of the following are dynamic algorithms?
- Distance vector routing
 - Flooding algorithm
 - Link state routing
 - Path vector algorithm
- (a) Only II, III and IV (b) Only I, II and IV
(c) Only I, II and III (d) Only I, III and IV
- [Ans: (d)]
- T2.** Which of the following is NOT true?
- BGP is an intra domain protocol
 - RIP is a path vector routing algorithm
 - OSPF is a distance vector routing algorithm
 - All of the above
- [Ans: (d)]
- T3.** Consider a network having 6 nodes A, B, C, D, E and F. The measured delay between A to B, A to D and A to C are 4, 5 and 6 respectively. Which of the following is routing table of A using distance vector routing? The vector tables of B, D, C are given as follows:
- (A, B, C, D, E, F)
- Vector table of B = (2, 0, 4, 4, 3, 2)
Vector table of C = (5, 4, 0, 2, 7, 4)
Vector table of D = (5, 1, 3, 0, 3, 6)
- (a) via
- | | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 0 | 4 | 6 | 5 | 7 | 6 | |
| - | B | C | D | B | B | |
- (b) via
- | | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 0 | 6 | 6 | 4 | 5 | 7 | |
| - | B | C | D | B | B | |
- (c) via
- | | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 0 | 4 | 6 | 6 | 5 | 7 | |
| - | B | C | D | B | B | |
- (d) None of these
- [Ans: (a)]
- T4.** Pick the true statements from the following.
- Circuit switching is a store and forward technique.

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- (ii) Packet switching is faster compared to circuit switching.
(iii) Packet switching wastes less resources compared to circuit switching.
(iv) Packet switching is not a store and forward technique.
- (a) Only (ii) (b) (ii) and (iii)
(c) Only (i) and (iv) (d) All of these
- [Ans: (b)]
- T5.** Consider a route in a store and forward network going through 9 intermediate nodes. The packet contains 1100 bits and are transmitted at 64 Kbps. Assume propagation delay over the links are negligible. As a packet travels along the route, it encounters an average of 5 packets when it arrives at each node. How long does it take for the packet to get to the receiver if the nodes transmit on a "first come first served" basis (in ms)?
- [Ans: (945.3)]
- T6.** Which of the following assertions is False about the IP?
- IP is possible for a computer to have multiple IP addresses
 - IP packets from the same source to the same destination can take different routes in the network
 - IP ensures that a packet is discarded if it is unable to reach its destination within a given number of hops
 - The packet source cannot see the route of an outgoing packets the route is determined only by the routing tables in the routers on the way
- [Ans: (d)]
- T7.** An IP datagram of size 1000 bytes arrives at a router. The router has to forward this packet on a link whose MTU (maximum transmission unit) is 100 bytes. Assume that the size of the IP header is 20 bytes. The number of fragments that the IP datagram will be divided into for transmission is _____.
- [GATE-2016, Ans: (13)]



6

Network Layer-Inter Networking



Multiple Choice Questions

- Q.1** A time-exceeded message is generated if _____.
- The round trip time between hosts is close to zero
 - The time-to-live field has a zero value
 - Fragments of a message do not arrive within a set time
 - Both (b) and (c)
- Q.2** Errors in the header or option fields of an IP datagram require a _____ error message.
- Parameter problem
 - Source quench
 - Router solicitation
 - Redirection
- Q.3** Checksum is provided only for IP header
- So that processing time of router will be less, packet will be forwarded fastly.
 - So that packet will reach to correct destination, if it reaches.
 - For inside segment already checksum is calculated by TCP in transport layer.
 - All of above
- Q.4** Which of the following assertions is FALSE about the Internet Protocol (IP)?
- It is possible for a computer to have multiple IP addresses
 - IP packets from the same source to the same destination can take different routes in the network

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- IP ensures that a packet is discarded if it is unable to reach its destination within a given number of hops
- The packet source cannot set the route of an outgoing packets; the route is determined only by the routing tables in the routers on the way

[GATE-2003]

- Q.5** Consider a source computer(s) transmitting a file of size 10^6 bits to a destination computer over a network of two routers (R_1 and R_2) and three links (L_1 , L_2 and L_3). L_1 connects S to R_1 ; L_2 connects R_1 to R_2 and L_3 connects R_2 to D. Each link of length 100 km. Assume signals travel over each link data speed of 10^8 m/sec. B.W of each link is 1 Mbps file be broken down into 1000 packets each of size 1000 bits. Find the total sum of transmission and propagation delays in transmitting the file from S to D?
- 1005 ms
 - 1010 ms
 - 3000 ms
 - 3003 ms
- Q.6** ICMP error messages are transmitted by
- Intermediate routers
 - Destination host
 - Both (a) and (b)
 - None of these
- Q.7** Count infinity problem is solved by
- Distance vector routing algorithm
 - Distance vector with split horizon
 - Distance vector with poison reverse
 - None of these
- Q.8** Host A (on TCP/IPv4 network A) sends an IP datagram D to host B (also on TCP/IPv4 network B). Assume that no error occurred during

transmission of D. When D reaches B, which of following IP header fields may be different from original datagram D?

- (i) TTL
 - (ii) Checksum
 - (iii) Fragment offset
 - (a) (i) only
 - (b) (i) and (ii) only
 - (c) (ii) and (iii) only
 - (d) (i), (ii), (iii)

Q.9 Consider the following statements about routing protocols RIP, OSPF in IPv4 network.

- I. RIP uses distance vector routing.
 - II. RIP packets are sent using UDP.
 - III. OSPF packets are sent using TCP.
 - IV. OSPF operation is based on link state routing.

(a) I and IV only (b) I, II and III only
(c) I, II, IV only (d) II, III, IV only

Q.10 What to do with a packet for a Station which is not on the local network?

- (a) Send packet to gateway specified in the routing table.
 - (b) Discard packet.
 - (c) Use ARP to get physical address of the Station and send packet directly.
 - (d) Send packet to all stations using broadcast.

Q.11 Protocol field in IPv4 header is ‘1’ then it indicates

- (a) TCP packet (b) ICMP packet
(c) UDP packet (d) None of these

Q.12 The same field in IP which behaves same as sequence number field in TCP protocol

- (a) TTL value
 - (b) Protocol field value
 - (c) Identification number
 - (d) None of these

Q.13 Fields which can be changed by intermediate router in between in IPv4 protocol are

- (a) TTL value
 - (b) Options
 - (c) Both (a) and (b)
 - (d) None of these

Q.14 The combination of identification number and source IP address in IPv4 defines

- (a) Uniquely defines a packet
 - (b) Uniquely defines a packet leaving from source host
 - (c) Uniquely defines a segment
 - (d) None of these

Q.15 For a pseudo network in IPv4 protocol if total length is 16 bits and fragmentation offset is 12 bits. What does fragmentation offset indicates?

- (a) Starting address of fragment
 - (b) Multiplied by 16 gives starting address of fragment
 - (c) Size of packet
 - (d) None of these

Q.16 Fragmentation offset field is zero then which parameters in network layer for IP packet indicates

- (a) Packet
 - (b) First fragment
 - (c) Second fragment
 - (d) Both (a) and (b)

Q.17 No ICMP error message is generated for

- (a) Packet having special address such as 127.0.0.0 or 10.0.0.0
 - (b) Packet having multicast address
 - (c) Both (a) and (c)
 - (d) None of these

Q.18 Trace route program is

- (a) Server program only
 - (b) Client program only
 - (c) Both (a) and (b)
 - (d) None of these

Q.19 Trace route program gets helps from error reporting messages

- (a) Source quench message
 - (b) Time exceeds message
 - (c) Destination unreachable
 - (d) Both (b) and (c)

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3
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Numerical Answer Type Questions

Q.20 A TCP message consisting of 2100 bytes is passed to IP for delivery across two networks. The first network can carry a maximum payload of 1200 bytes per frame and the second network can carry a maximum payload of 400 bytes per frame, excluding network overhead. Assume that IP overhead per packet is 20 bytes. What is the total IP overhead in the second network for this transmission (in bytes)?

[GATE IT-2004]

Q.21 How long (in bytes) is the IP header in minimum?



Multiple Select Questions

Q.22 Which of the following are correct?

- (a) The value of the urgent pointer field added to get the last byte of urgent data.
- (b) The start of the urgent data is not defined explicitly.
- (c) Urgent data is handled by IP.
- (d) Urgent pointer is of 16 bit field.

Q.23 Which of the following are correct?

- (a) Hub transmit the data to all the ports on the devices.
- (b) Bridge builds the connections with the similar networks which uses the same protocol.
- (c) VLAN switch transmit the data only to that VLAN port which is connected to the destination devices.
- (d) Router after checking the header of the packet it forwards the packet to the next hop on the path to destination.

Q.24 Which of the following are correct?

- (a) IP delivers packets to destination computer.
- (b) IP provides only best-effort connection less packet transfer.

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- (c) Gateway may discard packets when they encounter congestion.
- (d) IP packets contains socket address in their destination fields.



Try Yourself

T1. Match the following TCP timers with their functionality.

List-I

- A. RTO timer
- B. Keep alive timer
- C. Persistent timer
- D. Time WAIT timer

List-II

- 1. It runs for twice the maximum packet life time to make sure all packets are died off when connection is closed.
- 2. It is designed to prevent dead lock.
- 3. After this timer goes off the system will check if other side system is still there.
- 4. If ACK failed to arrive before the timer goes off, then segment is retransmitted.

Codes:

A	B	C	D
(a) 1	2	3	4
(b) 4	3	2	1
(c) 1	4	3	2
(d) 1	3	4	2

[Ans: (b)]

T2. Two hosts are connected via a packet switch with 10^7 bits per second links. Each link has a propagation delay of 20 microseconds. The switch begins forwarding a packet 35 microseconds after it receives the same. If 10000 bits of data are to be transmitted between the two hosts using a packet size of 5000 bits, the time elapsed between the transmission of the first bit of data and the reception of the last bit of the data in microseconds is _____.

[GATE-2015, Ans: (1575)]

- T3. Which of the following is NOT true with respect to a transparent bridge and a router?
- (a) Both bridge and router selectively forward data packets
 - (b) A bridge uses IP addresses while a router uses MAC addresses
 - (c) A bridge builds up its routing table by inspecting incoming packets
 - (d) A router can connect between a LAN and a WAN

[Ans: (b)]

- T4. For which of the following reasons does IP use the TTL in IP datagram header?
- (a) Ensure packets reach destination within that time
 - (b) Discard packets that reach later than that time
 - (c) Prevent packets from looping indefinitely
 - (d) Limit the time for which a packet gets queued in intermediate routers

[Ans: (c)]

- T5. Which of the following explains best about TTL?
- (a) Used for prioritizing packets
 - (b) Used to reduce delays
 - (c) Used to optimize throughput
 - (d) Used to prevent packet looping

[Ans: (d)]

- T6. For a host machine that uses the token bucket algorithm for congestion control, the token bucket has a capacity of 1 megabyte and the maximum output rate is 20 megabytes per second. Tokens arrive at a rate to sustain output at a rate of 10 megabytes per second. The token bucket is currently full and the machine needs to send 12 mega bytes of data. The minimum time required to transmit the data is _____ seconds.

[GATE-2016, Ans: (1.1)]



7

Transport Layer



Multiple Choice Questions

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Linked Answer for Q.1 & Q.2

- Q.1** The TCP round trip time is currently 35 msec, and it takes a segment at this moment to be acknowledged in 32 ms after which the new RTT value is to be calculated. Then the next acknowledgment comes in after 40 ms. If $\alpha = 0.9$ then finally what will be the new estimated RTT?
- (a) 34.7 ms (b) 35.5 ms
 (c) 35.23 ms (d) 38.4 ms

- Q.2** What will be the retransmission after time-out in basic algorithm?
- (a) 70.46 ms (b) 86.14 ms
 (c) 70.10 ms (d) 76.8 ms

- Q.3** Which of the following statements is/are true?
 S_1 : TCP is connection-oriented, and packets follow the same route from sender to receiver
 S_2 : SMTP packets follow the same route from sender to receiver.
- (a) Only S_1 is true
 (b) Only S_2 is true
 (c) Both S_1 and S_2 are true
 (d) Both S_1 and S_2 are false

- Q.4 Assertion (A):** TCP cannot be used for multicasting and broadcasting applications.

Reason (R): Congestion window in TCP dictates the traffic flow.

- (a) Both (A) and (R) are true and (R) is the correct reason for (A)

- (b) Both (A) and (R) are true and (R) is not the correct reason for (A)
 (c) Both (A) and (R) are false
 (d) (A) is true but (R) is false

- Q.5** Suppose Host A sends over a TCP connection to Host B one segment sequence number 38 and 4 bytes of data. What will be acknowledgments number for the subsequent segment?
- (a) 38 (b) 39
 (c) 42 (d) 54

- Q.6** Which one of the following will definitely result in data gram fragmentation?
- (a) Transmitting over a message-switched network
 (b) Transmitting over a circuit-switched network
 (c) Transmitting over a packet-switched network
 (d) Transmitting datagrams longer than the maximum transmission unit

- Q.7** Which of the following functionalities must be implemented by a transport protocol over and above the network protocol?
- (a) Recovery from packet losses
 (b) Detection of duplicate packets
 (c) Packet delivery in the correct order
 (d) End to end connectivity

[GATE-2003]

- Q.8** Which one of the following uses UDP as the transport protocol?
- (a) HTTP (b) Telnet
 (c) DNS (d) SMTP

[GATE-2007]

Q.9 Match the following:

- | | |
|---------|----------------------|
| P. SMTP | 1. Application layer |
| Q. BGP | 2. Transport layer |
| R. TCP | 3. Data link layer |
| S. PPP | 4. Network layer |
| | 5. Physical layer |
- (a) P - 2, Q - 1, R - 3, S - 5
 (b) P - 1, Q - 4, R - 2, S - 3
 (c) P - 1, Q - 4, R - 2, S - 5
 (d) P - 2, Q - 4, R - 1, S - 3

[GATE-2007]

Q.10 What is the maximum size of data that the application layer can pass on the TCP layer below?

- (a) Any size
 (b) 2^{16} bytes -size of TCP header
 (c) 2^{16} bytes
 (d) 1500 bytes

[GATE-2008]

Q.11 In the slow start phase of the TCP congesting control algorithm, the size of the congestion window

- (a) Does not increase
 (b) Increase linearly
 (c) Increases quadratically
 (d) Increases exponentially

[GATE-2008]

Q.12 A client process P needs to make a TCP connection to a server process S. Consider the following situation: the server process S executes a socket(), a bind() and a listen() system call in that order, following which it is preempted. Subsequently, the client process P executes a socket() system call followed by connect() system call to connect to the server process S. The server process has not executed any accept() system call. Which one of the following events could take place?

- (a) Connect() system call returns successfully
 (b) Connect() system call will wait
 (c) Connect() system call returns an error
 (d) Connect() system call results in a core dump

[GATE-2008]

Q.13 Which one of the following statements is False?

- (a) TCP guarantees a minimum communication rate
 (b) TCP ensures in-order delivery
 (c) TCP reacts to congestion by reducing sender window size
 (d) TCP employs retransmission to compensate for packet loss

[GATE IT-2004]

Q.14 On a TCP connection, current congestion window size is congestion window = 4 kB. The window size advertised by the receiver is Advertise Window = 6 kB. The last byte sent by the sender is last byte Sent = 10240 and the last byte acknowledged by the receiver is 8192. The current window size at the sender is
 (a) 2048 bytes (b) 4096 bytes
 (c) 6144 bytes (d) 8192 bytes

[GATE IT-2005]

Q.15 Consider a TCP connection in a state where there are no outstanding ACKs. The sender sends two segments back to back. The sequence numbers of the first and second segments are 230 and 290 respectively. The first segment was lost, but the second segment was received and Y be the ACK number sent by the receiver. X be the size of the first segment.

The Values of X and Y (in that order) are

- (a) 60 and 290 (b) 230 and 291
 (c) 60 and 231 (d) 60 and 230

[GATE IT-2007]

Q.16 Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I

- A. TELNET
 B. FTP
 C. NNTP
 D. DNS

List-II

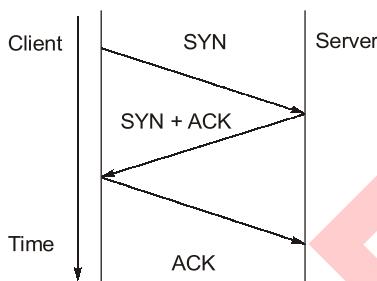
1. Mapping host names onto their network address

2. Move data efficiency from one machine to another
3. Allows user on one machine to log into a distant machine and work there
4. Moving new articles around
5. The protocol used for fetching pages on the World Wide Web

Codes:

A	B	C	D
(a) 2	1	4	5
(b) 3	2	1	4
(c) 3	2	4	1
(d) 1	2	3	4

Q.17 The three way handshake for TCP connection establishment is shown below:



Which of the following statements are TRUE?

- S₁:** Loss of SYN + ACK from the server will not establish a connection.
- S₂:** Loss of ACK from the client cannot establish the connection.
- S₃:** The server moves LISTEN → SYN_RCVD → SYN_SENT → ESTABLISHED in the state machine on no packet loss.
- S₄:** The server moves LISTEN → SYN_RCVD → ESTABLISHED in the state machine on no packet loss.
- (a) S₂ and S₃ only (b) S₁ and S₄ only
 (c) S₁ and S₃ only (d) S₂ and S₄ only

[GATE IT-2008]

Q.18 Which of the following is false about DNS?

- (a) DNS is a client server application
 (b) DNS uses the services of UDP for the messages of <512 BN, Otherwise TCP

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- (c) DNS tree can have only 64 levels
- (d) DNS organizes the name space in a hierarchical structure

- Q.19** Error control is needed at the transport layer because of potential error occurring
- (a) from transmission line losses
 - (b) in routers
 - (c) due to out of sequence delivery
 - (d) from packet losses

[DRDO-2009]

Q.20 Find the match between the elements of **List-I** and **List-II** as given below:

List-I

- A. NNTP
- B. SSH
- C. Daemon
- D. Tomcat

List-II

1. Web server
2. Background process for system administration
3. Protocol to read and post news
4. Allow to connect securely to remote machine
5. Mail sever

Codes:

A	B	C	D
(a) 5	2	4	3
(b) 3	4	2	1
(c) 5	4	2	1
(d) 3	2	4	5

[DRDO-2009]

Q.21 Telnet has

- (a) Separate data and control connection
- (b) Common connection for data and control
- (c) Default port number is 25
- (d) None of these

Q.22 HTTP is

- (a) Statefull protocol
- (b) Stateless protocol
- (c) Default port number 80
- (d) Both (b) and (c)

Q.23 SMTP is

- (a) Default port is 30
- (b) Textbase protocol
- (c) Push protocol
- (d) Both (b) and (c)

Q.24 HTTP has

- (a) Persistent connection
- (b) Nonpersistent connection
- (c) Both (a) and (b)
- (d) None of these

Q.25 Consider a TCP client and a TCP server running on two different machines. After completing data transfer, the TCP client calls **close** to terminate the connection and a FIN segment is sent to the TCP server. Server-side TCP responds by sending an ACK, which is received by the client-side TCP. As per the TCP connection state diagram (RFC 793). In which state does the client-side TCP connection wait for the FIN from the server-side TCP?

- (a) LAST-ACK
- (b) TIME-WAIT
- (c) FIN-WAIT-1
- (d) FIN-WAIT-2

[GATE-2017]

Q.26 Consider socket API on a Linux machine that supports connected UDP sockets. A connected UDP socket is a UDP socket on which **connect** function has already been called. Which of the following statements is/are CORRECT?

- I. A connected UDP socket can be used to communicate with multiple peers simultaneously.
 - II. A process can successfully call **connect** function again for an already connected UDP socket.
- (a) I only
 - (b) II only
 - (c) Both I and II
 - (d) Neither I nor II

[GATE-2017]

Q.27 A program on machine X attempts to open a UDP connection to port 5376 on a machine Y, and a TCP connection to port 8632 machine Z. However, there are no application listening at the corresponding ports on Y and Z. An ICMP Port unreachable error will be generated by

- (a) Y but not Z
- (b) Z but not Y
- (c) Neither Y nor Z
- (d) Both Y and Z

Q.28 Suppose Host A is sending Host B a large file over a TCP connection. Then which of the following statements is/are true?

S₁: The number of unacknowledged bytes that A sends cannot exceed the size of the receiver buffer

S₂: If the sequence number for a segment of this connection is m , then the sequence number of the subsequent segment will be necessarily $(m + 1)$

- (a) Only S_1
- (b) Only S_2
- (c) Both S_1 and S_2
- (d) None of these

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Numerical Answer Type Questions

Q.29 TCP operates over a 40 Gbps link. If TCP uses the full bandwidth continuously, how long (in ms) would it take the sequence numbers to wraparound completely?

Q.30 Suppose that the maximum transmit window size for a TCP connection is 12000 bytes. Each packet consists of 2000 bytes. At some point of time, the connection is in slow-start phase with a current transmit window of 4000 bytes. Subsequently the transmitter receives two acknowledgment. Assume that no packets are lost and there are no time-outs. What is the maximum possible value of the current transmit window? (in bytes)

[GATE IT-2004]

Q.31 If TCP uses 32 bits in TCP header for sequence number field, what is the TCP sequence number wraparound time (in minutes) for 45 Mbps line?

Q.32 A resource record of DNS has Time to live field which gives the indication of how stable the record is. Such information which is highly stable is assigned to _____.



Multiple Select Questions

Q.33 Which of the following statement are true?

- (a) UDP is transport layer protocols which are most suitable for DNS.
- (b) Wastage of IP address in classfull addressing is more as compared to classless addressing.
- (c) To avoid overhead, resulting by increase in packets due to fragmentation we should assemble packet at the end node.
- (d) None of these

Q.34 Which of the following are correct?

- (a) HTTP can use multiple TCP connections between the same client and the server.
- (b) POP protocol is used to download an e-mail from mailbox server to a mail client.
- (c) SMTP is not used for transferring e-mail messages from the recipients mail server to the recipients personal computer.
- (d) None of these

Q.35 Which of the following statements are correct?

- (a) In TCP, sending and receiving data is done as sequence of characters.
- (b) To achieve reliable transport in TCP, segment is used to check the safe and sound arrival of data.
- (c) Bytes of data being transferred in each connection are numbered by TCP. These numbers start with a sequence of zero's and one's.
- (d) The value of acknowledgment field in a segment defines sequence number of the next byte to be received.

Q.36 Which of the following is true in case of TCP protocol?

- (a) TCP can accept out of order segments.
- (b) There is no separate acknowledgment in case of TCP.

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- (c) TCP supports full duplex operations.
- (d) TCP provides both flow control as well as error control.



Try Yourself

T1. Assume that the bandwidth for a TCP connection is 1048560 bits/sec. Let a be the value of RTT in milliseconds (rounded off to the nearest integer) after which the TCP window scale option is needed. Let b be the maximum possible window size with window scale option. Then the values of a and b are

- (a) 63 milliseconds 65535×2^{14}
- (b) 63 milliseconds 65535×2^{16}
- (c) 500 milliseconds 65535×2^{14}
- (d) 500 milliseconds 65535×2^{16}

[GATE-2015, Ans: (c)]

T2. Let the window size be W at the beginning of RTT. Assuming there are no losses in the RTT time. What are the respective window sizes for SLOW START and CONGESTION AVOIDANCE after completion of RTT?

- (a) $2W - 1, \frac{2W + 1}{2}$
- (b) $W + 1, \frac{2W}{2}$
- (c) $W + 1, W - 1$
- (d) $2W, W + 1$

[Ans: (d)]

T3. The initial congestion window size over a TCP is 1. If slow start algorithm is used and the size of congestion window incremented by 1 whenever an ACK is received i.e. after first round trip time congestion window size is 2 segments. Assume connection never leaves slow start. Find the number of RTT's to send 3999 segments.

[Ans: (12)]

