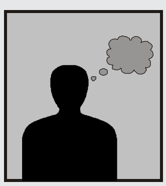
GATE

MADE EASY WORKBOOK 2026



Detailed Explanations of Try Yourself *Questions*

Computer Science & IT

Computer Networks

MADE EASY PUBLICATIONS

1 Basic Concepts

Detailed Explanation of Try Yourself Questions

T1 : Solution

(c)

IP belongs to network layer. Transport layer deals with port numbers.

T2 : Solution

(a)

Security layer is not a layer in the ISO-OSI model.

T3 : Solution

(c)

All the statements I, II and III are true. Because the service that is provided by the upper and lower layer matters and it does not matter as to how they are implemented.

T4 : Solution

(c)

Data frame always encapsulate packet.

T5 : Solution

(b)

The technique of merging inputs of many links onto one link is called multiplexing.

T6 : Solution

(a)

Data link layer : Ensure reliable transport of data over a physical point to point link.
Network layer : Routes data from one network node to the next.
Transport layer : Allow end to end communication between 2 processes.

T7 : Solution

(800)

$$\frac{9600}{(1+1+8+2)} = 800 \text{ characters}$$

T8 : Solution

(a)

Protocols are agreements on how communication components and DTE's are to communicate.

T9 : Solution

(b)

Session layer : Provides organised means to exchange data between users.
Transport layer : Provides end to end connectivity.
Application layer : Supports an end user process and perform required file transfer.
MDI (Medium Dependent Interface) : Connects DCE into physical channel.

■■■■

2 IP Addressing

Detailed Explanation of Try Yourself Questions

T1 : Solution

(b)

Packet A: The source IP contain direct broad cast address and we never use direct broadcast address in source IP. It is always used in destination IP. Hence packet A never exists.

Packet B: If destination IP address contain all 1's then it broadcasts within same network (Limited Broadcasting).

Packet C: It is a unicast packet within the same network as network ID 24.0.0.0 is same for both source and destination IP.

T2 : Solution

(d)

I.P	205.18.136.187
Mask	255.255.255.240
	205.18.136.176 This is subnet ID.

176 → 1 011 0000 (1 011: 4 Subnet bits)

$\therefore$ It is 11^{th} subnet

For direct broadcast address. All host bits must be one's. 1011 **1111**

$\Rightarrow$ 205.18.136.191 is direct broadcast address.

T3 : Solution

(a)

We use the concept of the longest matching subnet mask.

Perform and operation with the mask and select the network Id that matches longest with the given IP. If the network Id obtained by performing AND operation does not match with the given network Id's then default path is chosen.

Hence the following are the paths chosen by given IP's.

128.96.171.92 : Interface 0

128.96.167.151 : R2

128.96.163.121 : R4

128.96.165.121 : R3

T4 : Solution

(d)

The mask 255.255.255.224 gives different Network Id for the 10.105.1.113 and 10.105.1.9, when AND operations is performed. All the remaining masks gives same Network Id for both IP addresses.

Hence 255.255.255.224 cannot be used.

T5 : Solution

(c)

We have three identification bits for class C IP addresses. Hence effectively we have 21 bits which results in 2^{21} usable networks.

T6 : Solution

(a)

(*i*) Half of 4096 host addresses must be given to A we can set 21^{st} bit to 1 (for network part)

So valid allocation for A is : 245.248.136.0/21

(*ii*) For organisation B, set 21^{st} bit from to '0' and 22^{nd} bit to 0 (for network part)

So valid allocation for B is : 245.248.128.0/22

$$\underbrace{\underset{245}{\underline{11110101}},\ \underset{248}{\underline{11111000}},\ \underline{1000}}_{20} \qquad \begin{matrix} 1 \rightarrow A \\ 00 \rightarrow B \end{matrix}$$

T7 : Solution

(1)

131.23.151.76
23 : 00010111

31.16.0.0/12	**0001** 0000	3
31.28.0.0/14	**000111** 00	5
131.19.0.0/16	**00010011**	2
131.22.0.0/15	**0001011** 0	1

The largest matching prefix after performing AND operation is 131.22.0.0/15.

Therefore interface 1 would be chosen.

T8 : Solution

(c)

A : 0 – 126
B : 128 – 191
C : 192 – 223
D : 224 – 239
E : 242 – 255

X is class C, Y is class B and Z is class C.

T9 : Solution

(c)

The given IP 156.233.42.56 is a class B IP address with subnet mask of 7 bits. Therefore number of bits for hosts are 16 – 7 = 9.
The total number of hosts are $2^9 - 2 = 510$ and number of subnets are $2^7 - 2 = 126$.

T10 : Solution

(c)

127.0.0.1 is a loop back address and can not be assigned to host.
192.248.16.255 is a directed broadcast address as all the host bits are one and hence cannot be used as IP address for host.
150.7.0.0 is a network Id with all the host bits as zero. Hence this cannot be given as IP address to a host.
Therefore the only valid IP address is 25.5.25.55.

■■■■

3 Data Link Layer

Detailed Explanation of Try Yourself Questions

T1 : Solution

(0.2)

In 1 sec $\rightarrow$ 1000×10^6 bits

In RTT time $\rightarrow$ 250 μsec $\times 1000 \times 10^6$ = 250000 bits.

Number of frames that can be transmitted in RTT = $\frac{250000}{500}$ = 500 frames

But in Stop and Wait ARQ we can send only 1 frame in RTT

$\therefore$ Utilization $= \frac{1}{500} \times 100 = 0.2\%$

T2 : Solution

(b)

The given CRC polynomial is 1001 ($x^3 + 1$).

The given message 11001001 is appended with the remainder obtained by dividing 11001001**000** with 1001.

```
                   110100011
          1001 ) 11001001000
                 1001
discard ------> 01011
                 1001
discard ------> 00100
                  0000
discard ------> 01000
                   1001
discard ------> 00011
                    0000
discard ------> 00110
                     000
discard ------> 01100
                      1001
discard ------> 01010
                       1001
discard ------> 0[011] <---- append
```

The remainder after the division is **011** which is appended to message before transmission.
Hence the transmitted message is 11001001**011**.

T3 : Solution

(4)

$$\text{Transmission time} = \frac{\text{Frame size}}{\text{Band width}}$$

$$\text{T.T.} = \frac{1024 \times 8}{128 \times 10^3} = \frac{1028}{16}\text{msec}$$

$$= 64 \text{ msec } [\therefore\ 1\text{ K} = 2^{10}]$$

$$\text{Efficiency} = \text{w.s.} \times \frac{\text{T.T.}}{\text{T.T.} + 2\text{P.T.}}$$

$$100\% = \text{w.s.} \times \frac{1}{1 + 2\dfrac{\text{P.T.}}{\text{T.T.}}}$$

$$1 + 2\frac{\text{P.T.}}{\text{T.T.}} = \text{w.s.}$$

$$1 + 2\left[\frac{150}{64}\right] = \text{w.s.}$$

$$1 + 2[2.34] = \text{w.s.}$$

$$\text{w.s.} = \lceil 5.68 \rceil = 6$$

In selective repeat ARQ.
Total window size $\geq \log_2$ (S.w.s. + R.w.s.) and Sender w.s. = Receiver w.s.
So, total w.s. $\geq \log_2[6 + 6] = \log_2[12] = 4$

T4 : Solution

(2500)

$$\text{Sender throughput} = \frac{\text{Data}}{\text{Total time}}$$

$$= \frac{1000 \text{ bytes}}{0.1+0.1+0.1+0.1} = 2500 \text{ bytes/sec}$$

■■■■

4 MAC-Sublayer

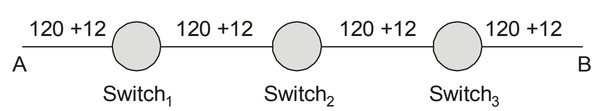
Detailed Explanation *of* Try Yourself Questions

T1 : Solution

(528)

Transmission time of A for putting packet on to the ethernet,

$$\frac{1500 \times 8}{10^8} = 120\ \mu s$$



The time needed for last bit of packet to propagate to the first switch is 12 μs. The time needed for first switch to transmit the packet to second switch is (120 + 12) μs and the same happens for remaining switches, each segment introduces a 120 μs T_{delay}, 12 μs P_{delay}.

Thus, total latency = (120 + 12) + (120 + 12) + (120 + 12) + (120 + 12) = 528 μs.

T2 : Solution

(0.3456)

$$\begin{aligned} \text{P (of 2 stations)} &= 5C_2 \times P_{(\text{transmitting})}{}^2 \times P_{(\text{not transmitting})}{}^3 \\ &= 5C_2\,(0.4)^2\,(0.6)^3 \\ &= 10 \times 0.16 \times 0.216 = 0.3456 \end{aligned}$$

T3 : Solution

(1)

$$\begin{aligned} \text{Transmission time} &= 2 \times \text{Propagation delay} \\ \frac{1000}{100 \times 10^6} &= \frac{2 \times L}{2 \times 10^5 \times 10^3} \\ L &= 1000\ \text{m} = 1\ \text{km} \end{aligned}$$

T4 : Solution

(40000)

$$\text{Data rate} = 4 \text{ Mbps}$$
$$\text{Token holding time} = 10 \text{ m sec}$$
$$\text{Frame length} = 4 \times 10^6 \times 10 \times 10^{-3}$$
$$= 40000 \text{ bits}$$

T5 : Solution

(500)

100 base 5 cable means length of the cable is 500 m and bandwidth is 100 Mbps.

According to CSMA/CD Transmission delay = 2 × Propagation delay (P_d)

$$P_d = \frac{d}{v} = \frac{500\,\text{m}}{2 \times 10^8\,\text{m/s}} = 2.5\ \mu\text{sec}$$

$$\frac{\text{Frame size}(x)}{\text{Bandwidth}} = 2 \times \frac{d}{v}$$

$$\Rightarrow \quad x = 2 \times 2.5\ \mu\text{sec} \times 100 \text{ Mbps}$$
$$= 500 \text{ bits}$$

T6 : Solution

(200)

$$\text{Bandwidth} = 20 \times 16^6 \text{ bps}$$
$$\text{Propagation time} = 40\ \mu\text{sec}$$

For ethernet,

Transmission time = 2 × Propagation time

$$\frac{\text{Frame size}}{20 \times 10^6 \text{ bits/sec}} = 2 \times 40\ \mu\text{sec}$$

$$\text{Frame size} = 20 \times 10^6 \times 2 \times 40 \times 10^{-6} = 1600 \text{ bits}$$
$$= \frac{1600}{8} = 200 \text{ bytes}$$

T7 : Solution

(d)

Exponential back of algorithm reduce the possibility of collisions in next iteration.

■■■■

5 Network Layer

Detailed Explanation of Try Yourself Questions

T1 : Solution

(d)

Only flooding is a STATIC algorithm and rest all are Dynamic algorithms.

Distance vector, Path vector and Link state are Dynamic Routing Protocols.

T2 : Solution

(d)

Intra Domain Routing Protocols:
(b) **RIP:** Routing Information Protocol (D.V.R. Algorithm)
(c) **OSPF:** Open Shortest Path First (Link State Routing Algorithm)
Inter domain protocols:
(a) **BGP:** Border Gateway Protocol (Path Vector Routing Algorithm)

T3 : Solution

(b)

- Circuit switching is not a store and forward technique and path is predefined and router need not apply any routing algorithm until which packet would have to be stored at router. But packet switching is a store and forward technique.
- Packet switching is faster because it has only 1 phase (data transfer), where as circuit switching is slower because it is having 3 phases (connection establishment, data transfer and connection release).

T4 : Solution

(945.3)

Transmission delay for 1 packet = $\frac{1100}{64000} = \frac{11}{640}$

Total time = Transmission delay for 1 packet + 9 × (5 + 1) transmission delay for 1 packet.

$$= \frac{11}{640} + \frac{54 \times 11}{640} = 945.3 \text{ msec}$$

T5 : Solution

(d)

(d) is false because in source routing the path of the packet is predetermined.
Intermediate routers information is pre-provided and the packet has to go through that path.

T6 : Solution

(13)

MTU is 100 bytes, IP header is 20 bytes, IP datagram is 1000 bytes.
So, number of fragments are 13.

■■■■

6 Network Layer-Internetworking

Detailed Explanation of Try Yourself Questions

T1 : Solution

(b)

Persistent timer: It is designed to prevent dead lock. The receiver sends an acknowledgment with a window size of 0, telling the sender to wait. Later the receiver updates the window, but the packet with update is lost. Hence both are waiting and are in dead lock.

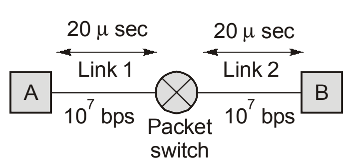
TIME WAIT: After this timer goes off the system will check if other side system is still there.

RTO: If ACK failed to arrive before the timer goes off, then segment is retransmitted.

Keep alive time: It runs for twice the maximum packet life time to make sure all packets are died off when connection is closed.

T2 : Solution

(1575)



Extra delay at switch = 35 μsec for each packet.

Data = 10000 bits

$$\text{Number of packets} = \frac{10000}{5000} = 2 \text{ packet}$$

Transmission delay for one packet = 500 μsec.

At t = 500 μsec, last bit of packet 1 is placed on link 1 by A and Transmission of packet begins.

At t = 520, last bit of packet 1 reaches switch.

At t = 555, first bit of packet 1 is placed on link 2 by switch.

At t = 1000, last bit of packet 2 is placed on link 1 by A.
At t = 1020, last bit of packet 2 reaches switch.
Note: pkt 2 need to wait upto 1055 μsec before switch transfers it.
Last bit of packet1 will be placed on link 2 by switch at 1055 μsec.
Hence No additional delay for packet 2.
At t = 1055 packet two first bit is placed on link 2.
At t = 1575 last bit of packet 2 reaches B.
∴ 1575 μsec is required.

T3 : Solution

(b)

Bridge doesn't understand IP address. It usually recognizes and considers the MAC address which is usually an ethernet address.

T4 : Solution

(c)

The combination of incorrect routing tables could cause a packet loop infinitely. A solution is to discard the packet after a certain time and send a message to originator (source) this value of certain time is called TTL (Time to Live).

T5 : Solution

(d)

TTL is used to prevent packet looping.

T6 : Solution

(1.1)

Time taken to transmit 1 MB when output rate is 20 MBps, capacity is 1 MB and token arrival rate is 10 MBps is

$$C + \rho S = MS$$

$$1\text{ MB} + (10\text{ MBps}) \times S \Leftarrow (20\text{ MBps}) \times S$$

$$S = \frac{1\text{ MB}}{(20-10)\text{ MBps}}$$

$$S = \frac{1\text{ MB}}{10\text{ MBps}} = 0.1\text{sec}$$

$$\text{In 0.1 sec data transmit} = 0.1 \times \text{Output rate}$$
$$= 0.1 \times 20\text{ MBps} = 2\text{ MB}$$
$$\text{Remaining data} = (12\text{ MB} - 2\text{ MB}) = 10\text{ MB}$$

So to transmit 1 MB takes 0.1 sec

$$\text{Then for 10 MB} = 10 \times 0.1\text{ sec} = 1\text{ sec}$$
$$\text{Total time} = (0.1 + 1)\text{ sec} = 1.1\text{ sec}$$

■■■■

7 Transport Layer

Detailed Explanation of Try Yourself Questions

T1 : Solution

(c)

Maximum windows size is the amount of data that can be transmitted in an RTT.

$$\therefore \qquad \text{RTT} = \frac{65535 \times 8}{1048560 \text{ bps}} = 500 \text{ ms}$$

For scaling factor 14 bits are used

T2 : Solution

(12)

Window size [WS = 1] initially

$\Rightarrow$ After 1 RTT, window size = 2 and 1 segment is sent

$\Rightarrow$ After 2 RTT, window size = 4 and 3 segment sent in total

$\Rightarrow$ After 3 RTT, window size = 8 and 7 segment sent in total

$\vdots$

$\Rightarrow$ After 'X' RTTS, window size = 2^x and $2^x - 1$ segment are sent

Now,
$$2^x - 1 = 3999$$
$$2^x = 4000$$
$$x = \log_2(4000)$$
$$\boxed{x = 12 \text{ RTT's}}$$

T3 : Solution

(c)

UDP and TCP are transport layer protocol. TCP supports electronic mail.

T4 : Solution

(c)

Listen( ) converts an unconnected active TCP socket into a passive socket.

■■■■