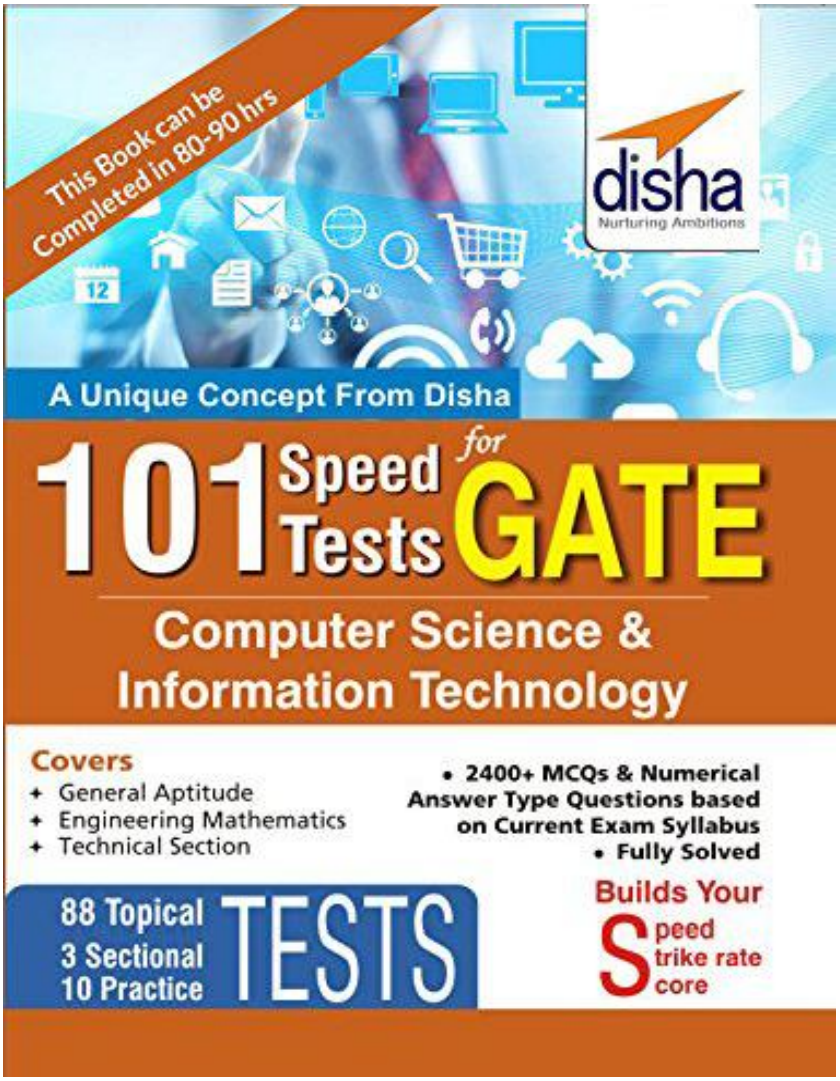
Transport Layer

This Chapter is taken from our Book:



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101 SPEED TEST

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Transport Layer

Max. Marks : 20 | No. of Qs. 20 | Time : 30 min. | Date : ...../...../.....

1. Consider an instance of TCP's Additive Increase Multiplicative Decrease (AIMD) algorithm where the Window size at the start of the slow phase is 2 MSS and the threshold at the start of the first transmission is 8 MSS. Assume that a timeout occurs during the fifth transmission. Find the congestion Window size at the end of the tenth transmission.
(a) 8 MSS (b) 14 MSS
(c) 7 MSS (d) 12 MASS

2. Which of the following transport layer protocols is used to support electronic mail?
(a) SMTP (b) IP
(c) TCP (d) UDP

3. A serial transmission Ti uses 8 information bits, 2 start bits, 1 stop bit and 1 parity bit foreach character. A synchronous transmission T2 uses 3 eight bit sync characters followed by 30eight bit information characters. If the bit rate is 1200 bits/second in both cases, what are thetransfer rates of Ti and T2?
(a) 100 characters/sec, 153 characters/sec
(b) 80 characters/sec, 136 characters/sec
(c) 100 characters/sec, 136 characters/sec
(d) 80characters/sec,153characters/sec

4. What is the minimum number of bits (l) that will be required to represent the sequence numbers distinctly? Assume that no time gap needs to be given between transmissions of two frames.
(a) ⊨2 (b) ⊨3
(c) ⊨4 (d) ⊨5

5. How many characters (7 bits + 1 parity) can be transmitted over a 2400 byte/s line, if the transfer is synchronous (1 start and 1 stop bit)_____?

6. On a wireless link, the probability of packet error is 0.2. a stop and wait protocol is used to transfer data across the link. The channel condition is assumed to be independent from transmission to transmission. What is the average number of transmission attempts requires to transfer 100 packets is _____?

7. Suppose two hosts use a TCP connection to transfer a large file. Which of the following statements is/are False with respect to the TCP connection?
1. If the sequence number of a segment is m, then the sequence number of the subsequent segment is always m+1.
2. If the estimated round trip time at any given point of time is t sec, the value of the retransmission timeout is always set to greater than or equal to t sec.
3. The size of the advertised window never changes during the course of the TCP connection.
4. The number of unacknowledged bytes at the sender is always less than or equal to the advertised window.

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

8. A link has a transmission speed of 10^6 bits/sec. It uses data packets of size 1000 bytes each. Assume that the acknowledgment has negligible transmission delay, and that its propagation delay is the same as the data propagation delay. Also assume that the processing delays at nodes are negligible. The efficiency of the stop-and-wait protocol in this setup is exactly 25%. The value of the one-way propagation delay (in milliseconds) is _____.

9. Assume that the bandwidth for a TCP connection is 1048560 bits/sec. Let α be the value of RTT in milliseconds (rounded off to the nearest integer) after which the TCP window scale option is needed. Let β be the maximum possible window size with window scale option. Then the values of α and β are.
(a) 63 milliseconds 65535×2^{16}
(b) 500 milliseconds 65535×2^{14}
(c) 500 milliseconds 65535×2^{16}
(d) 63 milliseconds 65535×2^{14}

10. Consider the following statements.
I. TCP connections are full duplex.
II. TCP has no option for selective acknowledgment
III. TCP connections are message streams.
(a) Only I is correct
(b) Only I and II are correct
(c) Only II and III are correct
(d) All of I, II and III are correct

11. 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 4×10^6 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 he sequence number field has to be _____.

12. 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 megabytes of data. The minimum time required to transmit the data is _____ seconds.

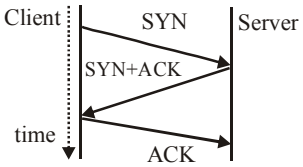
13. Consider the following statements about the timeout value used in TCP.
i. The timeout value is set to the RTT (Round Trip Time) measured during TCP connection establishment for the entire duration of the connection.

ii. Appropriate RTT estimation algorithm is used to set the timeout value of a TCP connection.
iii. Timeout value is set to twice the propagation delay from the sender to the receiver.

Which of the following choices hold?
(a) (i) is false, but (ii) and (iii) are true
(b) (i) and (iii) are false, but (ii) is title
(c) (i) and (ii) are false, but (iii) is true
(d) (i), (ii) and (iii) are false

14. 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 correctly by the receiver. Let X be the amount of data carried in the first segment (in bytes), and Y be the ACK number sent by the receiver. 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

15. 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
(c) S1 and S3 (d) S2 and S4

16. Which of the following TCP/IP protocol is used for file transfer with minimal capability and minimal overhand?
(a) RARP (b) FTP
(c) TFTP (d) TELNET

17. Which of the following TCP/IP protocal is used to monitor IP gateway and the networks to which they attach?
(a) SGMP (b) SUMP
(c) FTP (d) both (a) and (b)

18. Which of the following TCP/IP internet protocol a diskless machine uses to obtain its IP address from a server?
(a) RDP (b) ARP
(c) RIP (d) X.25

19. How many bits internet address is assigned to each host on a TCP/IP internet which is used in all communication with the host ?
(a) 16 bits (b) 32 bits
(c) 48 bits (d) 64 bits

20. A computer on a 10 Mbps network is regulated by a token bucket. The token bucket is filled at a rate of 2 Mbps. It is initially filled to capacity with 16 Megabits. What is the maximum duration for which the computer can transmit at the full 10 Mbps?

Hints & Solutions

1. (c) Given threshold = 8
Time = 1, during first transmission, window size = 2 (slow start phase)
Time = 2, congestion window size = 4 (double the no. of acknowledgments)
Time = 3, congestion window size is = 8
Time = 4, congestion window size = 9, after threshold (increase by one addictive increase)
Time = 5, transmits 10 MSS, but time out occurs congestion windw size = 10
Hence threshold = (congestion window size)/2=10/2 = 5
Time = 6, transmits 2
Time = 7, transmits 4
Time = 8, transmits 5(threshold is 5)
Time = 9, transmits 6
Time = 10, transmits 7
During 10th transmission, it transmits 7 segments hence at the end of the 10th transmission the size of congestion window is 7 MSS.

2. (c) E-mail uses SMTP (Simple Mail Transfer Protocol) in application layer to transfer mails and SMTP uses TCP (Transport Control Protocol) to transfer data in transport layer.

3. (c) In serial transmission 8 bit of actual data is present in 8 + 2 + 1 + 1(= 12) bits of each transmission. In one second 1200 bits are transferred. In 1200 bit only 1200*(8/12) bits of actual data is present, So actual transfer rate is 1200*(8/12)=800 bits =100 bytes=100 characters.
Similarly in synchronous transmission actual data rate is=1200*(30/33) bps=1090 bps=136 bytes per seconds

4. (d) Tx=1000/106 seconds=1 ms
Maximum number of frames that can be transmit to maximally pack them is=$(T_x + 2T_p)/T_x$
= (25+1)/1=26 which is window size
Minimum sequence numbers required = 26
Minimum number of bits required for sequence number is 5.

5. (a)

6. 125 error rate = 0.2 ,
In stop and wait protocol sender will transmits
100 * (1+0.2+0.22 +0.23 +0.24 +……) packets
= 100 * (1/(1-.02)) = 100/0.8 = 125 (sum of infinite G.P. is a/(a–r))

7. (b) TCP sequence number of a segment is the byte number of the first byte in the segment. For example, if the segment contains 500 bytes which are from 1000 to 1499, then sequence number of the segment would be 1000 and sequence number of next segment would be 1500. Receiver window changes when TCP data is processed by application layer of receiver side.

8. (c) In stop and wait, protocol next packet is sent only when acknowledgement of previous packet is received. This causes poor link utilization.
Tansmission speed = 10^6
Time to send a packet = (1000 * 8) bits / 10^6
= 8 miliseconds
Since link utilization or efficiency is 25%, total time taken for 1 packet is 8 * 100/25 = 32 miliseconds.
Total time is twice the one way propagation delay plus transmission delay. Propagation delay has to be considered for packet and ack both.
Transmission delay is considered only for packet as the question says that trans. time for ack is negligible.
Let propagation delay be x.
2x + 8 = 32.
x = 12.

9. (b) Since sequence number in TCP header is limited to 16 bits, the maximum window size is limited. When bandwidth delay product of a link is high, scaling is required to efficiently use link. TCP allows scaling of windows when bandwidth delay product is greater than 65,535 (Refer this). The bandwidth delay product for given link is 1048560 * α. Window scaling is needed when this value is more than 65535 bytes, i.e., when α is greater than 65535 * 8 / 1048560 or 0.5 seconds. Scaling is done by specifying a one byte shift count in the header options field. The true receive window size is left shifted by the value in shift count. A maximum value of 14 may be used for the shift count value. Therefore maximum window size with scaling option is 65535×2^{14}.

10. (a) TCP connections are byte streams. In TCP, selective acknowledgements is possible.

11. (8) Propagation time = (8000 * 1000)/ (4 * 10^6) = 2 seconds
Total round trip propagation time = 4 seconds
Transmission time for one packet = (packet size) / (bandwidth) = (10^7) / (500 * 10^6) = 0.02 seconds
Total number of packets that can be transferred before an acknowledgement comes back = 4 / 0.02 = 200
Maximum possible window size is 200.
In Go-Back-N, maximum sequence number should be one more than window size.
So total 201 sequence numbers are needed. 201 different sequence numbers can be represented using 8 bits.

12. (1.1) **13. (b)**

14. (16) Data in 1st segment is from byte number 230 to byte number 289, that is 60 bytes As 1st is lost so, TCP will send ACK for the next in-order segment receiver is expecting. So it will be for 230.

15. (b) If ACK is dropped, Server to client connection will not be established.

16. (c) **17. (d)**

18. (b) **19. 32 bits**

20. (b) Let the duration of transmission be x s.
Transmission Network of Computer by y s
Network initially filled with p Megabits
Initial rate of transmission be q per second
Now, from the above, we can easily formulate
$y + qx = xy \Rightarrow y = x(y - q)$
$\Rightarrow 16 = x(10 - 2) \Rightarrow x = 2$