# TCP & UDP PRACTICE QUESTIONS

1. The following is a dump of a UDP header in hexadecimal form: 06 32 00 0D 00 1C E2 17 What is the (a) Source port number (b) Destination port number (c) Total length of the UDP (d) Length of the data (e) Considering that an IP frame can have a maximum total length of 65 535 bytes, what is the maximum length of the data in a UDP frame?
2. The TCP sliding windows are byte-oriented. What does this mean?
3. A TCP connection uses a window size of 10,000 bytes, and the previous acknowledgment number was 22 001. It receives a segment with acknowledgment number 24 001. Draw a diagram to show the situation of the window before and after.
4. A client uses UDP to send data to a server. The data are 16 bytes. Calculate the efficiency of this transmission at the UDP level (ratio of useful bytes to total bytes). 4
5. A client uses TCP to send data to a server. The data are 16 bytes. Calculate the efficiency of this transmission at the TCP level (ratio of useful bytes to total bytes, assuming no options).
6. A TCP machine is sending windows of 65535 B over a 1 Gbps channel that has a 10 msec one-way delay.

    1. What is the maximum throughput achievable?
    2. What is the line efficiency?

7. In a TCP connection, the initial sequence number (ISN) at the client site is 3,070. The client opens the connection, sends only one segment carrying 1,200 bytes of data, and closes the connection. What is the sequence number of segments sent by the client?

8. The following is a dump of a TCP header in hexadecimal format

053200217 000000001 00000000 500207FF 00000000

1) What is the source port number?

2) What is the destination port number?

3) What is sequence number?

4) What is the acknowledgment number?

5) What is the length of the header?

6) What is the type of the segment?

7) What is the window size?

9. Suppose you are asked to design a new reliable byte-stream transport protocol like TCP. This protocol, named my TCP, runs over a 100 Mbps network with a Round Trip Time of 150 milliseconds and a maximum segment lifetime of 2 minutes. Which of the following is/are valid lengths of the Sequence Number field in the TCP header?

(1. 30  2. 32  3. 34  4. 36)

10. Consider the data transfer using TCP over a 1 Gbps link. Assuming that the maximum segment lifetime (MS) is set to 60 seconds, the minimum number of bits required for the sequence number field of the TCP header to prevent the sequence number space from wrapping around during the MSL is_____

11. Consider the three-way handshake mechanism followed during TCP connection establishment between hosts P and Q. Let X and Y be two random 32-bit starting sequence numbers chosen by P and Q, respectively. Suppose P sends a TCP connection request message to Q with a TCP segment having SYN bit =1, SEQ number =X, and ACK bit =0. Suppose Q accepts the connection request. Which one of the following choices represents the information present in the TCP segment header that is sent by Q to P?

12. Consider a TCP client and a TCP server running on two different machines. After completing the data transfer, the TCP client calls close to terminate the connectional 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 connections 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

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

14. On a TCP connection, the 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 LastByteSent = 10240, and the last byte acknowledged by the receiver is LastByteAcked = 8192. The current window size at the sender is:_____

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

16. What is the difference between TCP and UDP?

17. What is UDP? What is the maximum and minimum size of a UDP datagram? Also, discuss the use of UDP.

18. Explain the header format of TCP.

19. Explain the header format of UDP.

20. Compare the TCP header with the UDP header.

21. What is the session layer? discuss the design issue of the session layer.

22. Write the services provided by the session layer.

23. Describe the retransmission, simplex, half duplex, and full duplex transmission terms.

24. What is the presentation layer? Write the design issue of the presentation layer.

25. The HLEN field in the TCP header has a value of 10, and 1 byte of padding (composed of zeros) is added to ensure that the TCP header ends and data begins on a 32-bit boundary. Find the number of bytes of additional information present as a part of the options in the TCP header.

26. If the link of a network is 2 Mbps and the round trip time between source and destination is 300 msec, compute the optimal TCP window size required to utilize the line fully.

27. UDP is a message-oriented protocol. TCP is a byte-oriented protocol. If an application needs to protect the boundaries of its message, which protocol should be used, UDP or TCP?

28. Suppose that the UDP receiver computes the Internet checksum for the received UDP segment and finds that it matches the value carried in the checksum field. Can the receiver be absolutely certain that no bit errors have occurred? Justify

29. Explain why the size of the sender window must be less than 2m for Go-Back-N ARQ.

30. The distance from Earth to a distant planet is approximately 9×1010 m. What is the channel utilization if a stop-and-wait protocol is used for frame transmission on a 64 Mbps point-to-point link? Assume that the frame size is 32 KB and the speed of light is 3×108 m/s.

31. How does TCP determine the time-out for implicit detection of packet loss? Be brief

32. How does an ARQ system deal with packet loss?

33. In TCP, how many sequence numbers are consumed by the SYN+ACK segment? Justify.

34. Sketch the packet flow of TCP connection initiation and connection termination using a timing diagram

35. A link has a transmission speed of 106 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%. Calculate the propagation delay in milliseconds.

36. What is the limitation of Go-Back-N ARO? How is this limitation taken care of by Selective-Repeat ARQ

37. Why is it that voice and video traffic is often sent over TCP rather than UDP in today's internet?

38. Difference between Stop and wait , Selective Repeat. and W. Go-Back-N

39. How does TCP determine the time-out for implicit detection of packet loss? Be brief

40. A 3000 km long trunk operates at 1.536 Mbps and is used to transmit a 64-byte frame and uses Sliding Window Protocol. Suppose the propagation speed is 6 microsec/km. how many bits should the sequence number be?

41. Distinguish between packet-switched network and circuit-switched network.

42. In Go-back-N protocol with m=6, the sending machine is in the ready state with Sf=10 and Sn=15, An ACK with ACKNo =13 arrives. What are the next values of Sf, Sn, and Rn?

43. In a TCP connection, the initial sequence number at the client site is 2,171. The client opens the connection, sends three segments, the second of which carries 1,000 bytes of data, and closes the connection. What is the value of the sequence number in each of the following segments sent by the client?

a. The SYN segment

b. The data segment

c. The FIN segment

44. Explain how Go-Back-N-ARQ is different than Selective repeat ARQ with diagrams.

Why the window of Go-Back-N is selected as less than 2m? Explain the value of m=4.

45. Assume that, in a Stop-and-Wait system, the bandwidth of the line is 1 Mbps, and 1 bit takes 20 milliseconds to make a round trip. If the system data packets are 1,000 bits in length, what is the utilization percentage of the link?

46. In a packet switch network having Hops= 4, transfer 20 packets from A to B, given

packet size is L bits. The bandwidth to transfer data is R Mbps, and the speed of propagation is

S meter/sec. Assume the processing delay is P seconds, and the distance between two points is D

meters. Find the total time required for 10 packets to reach A from B.

47. Go back N protocol with a sender's window size of 'S' given. Let at a time 'T, the next in-order packet the receiver is expecting, have a sequence number of 'M.' If the medium is unable to reorder messages, what will be the sequence number of the last packet in the sender's window? (Assume the sender has already received the acknowledgments.)

48. Suppose the UDP receiver computes the Internet checksum for the received UP segment and finds that it matches the value carried in the checksum field. Can the receiver be absolutely certain that no bit errors have occurred? Justify.

49. Assume that a system uses five protocol layers. If the application program creates, a message of 100 bytes and each layer (including fifth and first) adds a header of 10 bytes to the data unit, what is the efficiency of the system?

50. If m number of bits is used for representing a sequence number in selective repeat ARQ, then the maximum size of the sliding window is 2^(m-1). Justify this statement using a boundary case example. What will happen if the size of the sliding window exceeds 2^( m-1)

51. Illustrate and explain the TCP State transition diagram. Write down the significance of the TIME state and 2MSL timeout.

52. In the Stop-and-Wait protocol, show the case in which the receiver receives a duplicate packet (which is also out of order). What is the reaction of the receiver to this event?

53. Station B needs to send a message consisting of 9 packets to Station C using a sliding window (window size 3) and go-back-n error control strategy. All packets are ready and immediately available for transmission. If every 5th packet that B transmits gets lost (but no acks from C ever get lost), then what is the number of packets that B will transmit for sending the message to C?

54. Explain the different fields of a TCP header along with a header diagram. If the size of a TCP segment is 1KB and the header length value is 6, the sequence number = 3500. Given that URG flag = 1 and URG pointer = 45. Then, how many of them are urgent data? Give the sequence numbers of urgent data.

55. The following is the information for a TCP Client and a Server:

- The MSS (Maximum Segment Size) in both directions is 1000 bytes. - The ISN (Initial Sequence Number) for the Client is 50, and for the Server is 81. The Client sends 2000 bytes to the Server, and the Server sends 3000 bytes to the client. Give the complete TCP message exchange between client and server. For each segment, draw a vector showing the value of the SYN, ACK, and FIN bits, with the value of the SEQ (Sequence Number) and the ACK (Acknowledgement Number). Assume no packets are lost, and the application consumes the data as soon as it is received.

56. (a) Explain the flow diagram of stop and wait protocol with both packet lost and acknowledgment lost scenarios.

(b) Assume that, in a Stop-and-Wait system, the bandwidth of the line is I Mbps, and 1 bit takes 20 milliseconds to make a round trip. What is the bandwidth-delay

product? If the system data packets are 1,000 bits in length, what is the utilization percentage of the link?

57. List five key differences between TCP and UDP. Specify the applications that are using TCP and UDP, respectively. Draw and explain TCP and UDP header.

58. Under what conditions does one go directly from FIN_WAIT_1 to TIME_WAIT?

59. a) Suppose two hosts, A and B, are connected by a 1 Mbps link of length 10 km. Suppose the speed of light over the link is 2 * 1018 m/s. If a 5 MB file were to be transferred between the hosts as back-to-back packets, how many bits would be in the link at any given time?

60. a) Suppose the maximum time an IP datagram can stay in the network before being delivered to the receiver is 60 sec (MSL: Maximum segment lifetime is 60 sec. What is the maximum rate at which a host should send out datagrams so as to avoid confusion during the reassembly of fragments at the receiver? Assume the datagram size of 1000 Bytes. Express the answer in Mbps.

61. Briefly state what you mean by Half-close and full-close. Draw the state transaction diagram for TCP with half-close connection termination

62. In a Noisy Channel, Selective Repeat ARQ protocol is implemented with m=3 (Number of bits for Sequence Number). Given that, packet 0 is sent with successful acknowledgment. Packet 1 gets lost due to noise. Packet 2 and Packet 3 are successfully sent. However, only packet 2 is successfully acknowledged, whereas packet 3's acknowledgment is lost due to noise. A suitable flow diagram shows the process of flow and error control using a sliding window with S, Sm, Rn, timer, and ACK.

63. In a packet-switched network, TTL= 128 (Sender) and TTL= 125 (receiver). Time to Live (TTL): Each time a packet jumps a router, the TTL value is decremented by '1'. The average Queuing delay in each intermediate router is 20 milliseconds, and the average processing delay in each intermediate router is 10 milliseconds. Link data- rate is 100Mbps—packet size 64 kilo-bytes. Consider that the Speed of the electrical signal in a guided media is 2/3 of the Speed of flight, and each intermediate node is separated by a distance of 100 kilometers from its adjacent node. Draw the flow diagram and calculate the following: How many

intermediate routers are present? Total time is taken for the packet to reach the receiver (in milliseconds)

64. (a) Suppose two hosts, A and B, are separated by 20,000 kilometers and are connected by a direct link of R = 2 Mbps. Suppose the propagation speed over the link is 2.5 x 10° m/s. i. Calculate the propagation delay, prop. ii. Calculate the maximum number of bits that can be in the link (i.e., the bandwidth-delay product, R x dprop. ). ill. Consider sending a file of 800,000 bits from Host A to Host B. Suppose the file is sent continuously as one large message. Calculate the total time taken to send the file.

65. Host A wants to send a large file to host B. The path from host A to host B has two links, of rates R1=3 Mbps and R2 =400 Kbs. Assuming no other traffic in the network, find out the throughput for the file transfer. If RI becomes half, then what is the throughput?

66. What is the limitation of Go-Back-NARQ? How is this limitation taken care of by Selective-Repeat ARQ

67. Sketch the TCP connection initiation and connection termination packet flows using a timing diagram.

68. How does TCP determine the time-out for implicit detection of packet loss? Be brief.

69. Suppose two TCP connections are present over some bottleneck link of rate R bps. Both connections have a huge file to send (in the same direction over the bottleneck link). The transmissions of the files start at the same time. What transmission rate would TCP like to give to each of the connections?

70. Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110.

a. How much data is in the first segment?
b. Suppose that the first segment is lost, but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what will be the acknowledgment number?

71. Suppose a process in Host C has a UDP socket with port number 6789. Suppose both Host A and Host B each send a UDP segment to Host C with destination port number 6789. Will both of these segments be directed to the same

socket at Host C? If so, how will the process at Host C know that these two segments originated from two different hosts?

72. Consider a TCP connection between Host A and Host B. Suppose that the TCP segments traveling from Host A to Host B have source port number x and destination port number y. What are the source and destination port numbers for the segments traveling from Host B to Host A?

73. A TCP machine is sending full windows of 65,535 bytes over a 1-Gbps channel that has a 10-msec one-way delay. What is the maximum throughput achievable? What is the line efficiency?

Short Notes:

1. Checksum
2. TCP 4-way handshake for connection close-down
3. TCP Half close and Full close state transition diagram
4. Connection establishment of TCP protocol.
5. Stop and wait, ARQ vs. Selective Repeat vs. Go Back N
6. Piggybacking.
7. UDP datagram format.
8. TCP datagram format.

** Please go through all the book examples and all the book diagrams with explanations.

* If possible, go through text-book exercise questions.