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RV University, Bengaluru

School of Computer Science and Engineering

B.Tech (Hons.)

CIE-1 Question Paper – Set1 with Answer keys

Academic Year 2024-2025

Course: Network Security	**Course Code: CS3403**	**Semester: VI**
Date: 11 Feb 2025 **Duration: 70 minutes**	**Max Marks: 20**	

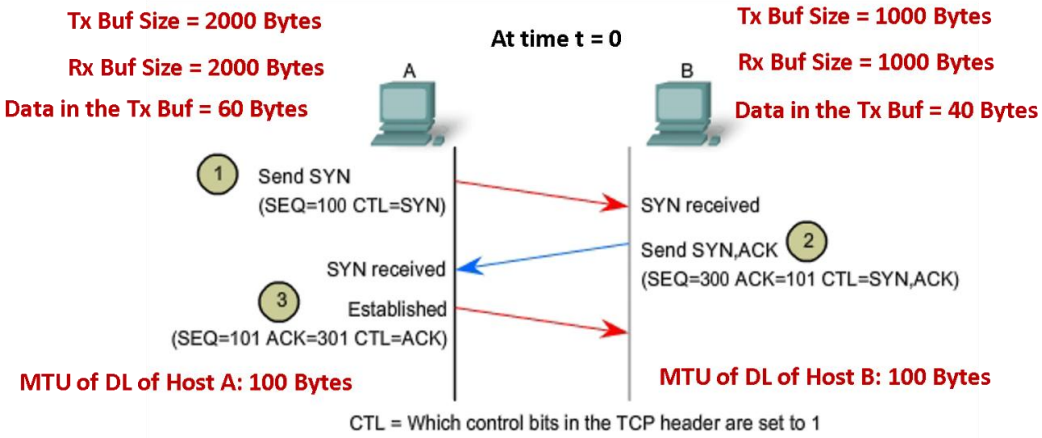
Sl. No.	Questions	Marks	L1-L6	CO
1.	Suppose computers A and B have IP addresses 10.120.**1**.114 and 10.120.1.125 respectively and they both use the same network mask N. Which of the values of N given below should not be used if A and B belong to the same network? A) 255.255.255.0 B) 255.255.255.224 C) 255.255.255.248 D) 255.255.0.0	**2**	**L4**	**1**
2.	Which is the most optimal and the most suitable subnet mask for a point-to-point link? Give all the valid host IDs in this subnet. Provide supporting explanation for your choice.	**2**	**L3**	**1**
3.	Assume two TCP connections are established from a Server with an IP address IPS to a Client machine with an IP address IPC. The TCP Port ID on IPS is PS1, and TCP Ports on the Client machine of these TCP connections are PC1 and PC2. Explanation is required. Choose the correct 4-tuple values [Src IP, Dest IP, Src Port, Dest Port] of one of the TCP segments going from the Server to the Client. **A) [**IPS, IPC, PC1, PS1] B) [IPS, IPC, PS1, PC2] C) [IPC, IPS, PS1, PC2]	**2**	**L3**	**1**
4.	Choose the TCP header field(s) which is/are always valid in any TCP segment. A) Acknowledgement no. B) Sequence no. C) Urgent pointer **Note**: Supporting explanation is required.	**2**	**L4**	**1**
5.	Explain why TCP is considered to be a reliable protocol.	**1**	**L2**	**1**
6.	In TCP, identify the significance of the TIME_WAIT state and how is it achieved by having this state? A) It avoids any new incoming connections between the same set of hosts and ports. B) It allows the receiver to request more data from the sender. C) It indicates that a connection is in progress and waiting for more data.	**1**	**L2**	**1**
7.	Give the functionality of the below function calls. Which one is a blocking call? socket.bind((HOST, PORT)) socket.listen()	**1**	**L3**	**1**
8.	Explain the functionality of the PSH flag in TCP.	**1**	**L2**	**1**

L1- Remember, L2- Understand, L3 – Apply, L4- Analyse, L5 – Evaluate, L6 – Create

Q9: L4 level CO1 **4 Marks**

The connection establishment between hosts A and B is as shown below. The buffer parameters and MTU values at each host at time = 0 are also given below. List of events **after time t=0** are:

a. After the connection establishment the Host A transmits the data first after t = 0.
b. Host A transmits next data only after it receives the ACK from the Host B, for the pervious data it sent. Host B transmits any data only when there is no data in transit from the Host A.
c. Host B while acknowledging the data from the Host A, it also sends its own data if available.
d. At any time, only one TCP segment is in transit between the Hosts A and B.
e. Assume any data sent by both the hosts are received at the other end without any error or loss.
f. Assume, the applications at both the ends do not interact at all with their respective TCP/IP stacks, after the below data were loaded prior to the time t = 0.

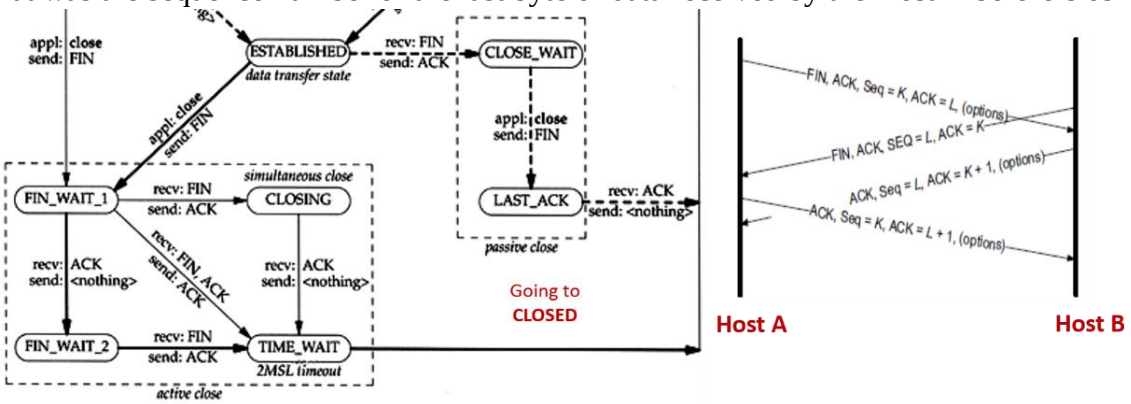


Give the following header values of **every TCP** segment that gets **transmitted** between the hosts in the **time order**, starting **from time = 0**, till all the data at the hosts get transmitted and acknowledged. Give the direction of each TCP segment, either from **Host AtoB or Host BtoA**.

1.Sequence number 2. TCP data length 3. Ack number 4. Window size 5. CTL bits (set)

Q10: L4 level CO1 **4 Marks**

a) Give the state transitions at Host A because of the message exchanges shown above.
b) Give the state transitions at Host B because of the message exchanges shown above.
c) What was the sequence number of the last byte of data received by the Host A before closing?
d) What was the sequence number of the last byte of data received by the Host B before closing?



Course Outcomes

1. Analyze the working principles and characteristics of TCP and its role in providing reliable networking applications.
2. Analyze the implementation details of RIP and OSPF routing protocols adapted by large enterprise networks.
3. Explain various multimedia transport protocols and the need for QoS in networks
4. Describe the working principles and the purpose of cryptographic algorithms used to provide secure communication
5. Apply IP security and Web security concepts in real-life scenarios for creating secure networks

Marks Distribution										
L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4	CO5
0	3	5	12	0	0	20	0	0	0	0

L1- Remember, L2- Understand, L3 – Apply, L4- Analyse, L5 – Evaluate, L6 – Create

Answers

1. **IP addresses assigned to A and B are: 10.120.1.114 and 10.120.1.125**
   114 → 0x74 → 0111 0100 and 125 → 0x7D → 0111 1101

Need to choose the subnet mask when applied to these IP addresses the Net ID part of the addresses should not be different.
Options A 255.255.255.0 and **D 255.255.0.0** when applied yield Net IDs as 10.120.1.0 and 10.120.1.0, which are the same, so these two are valid subnet masks.
Option B 255.255.255.224 → FF.FF.FF.E0 yields the same Net ID 10.120.1.96
Option C: 255.255.255.248 → FF.FF.FF.F8 yields different Net IDs: 10.120.1.112 and 10.120.1.120
So, Option C 255.255.255.248 cannot be used as subnet mask.
Note: Without proper explanation no marks will be awarded even if the correct option is chosen.

2. For a point-to-point link, there are only two valid IP addresses are required to be provided to the two ends of the link, for router interfaces. The most **optimal** and **suitable subnet mask is the /30** which can accommodate **maximum two host addresses**, which will be sufficient for the two interfaces of routers. Subnet mask → **/30** → 255.255.255.252 → 0xFF.FF.FF.FC - **1 mark (including for the explanation) valid host IDs are 1 and 2. – 1 mark**

3. **B is the correct option.**
The 4-tuple values are: [Src IP, Dest IP, Src Port, Dest Port] of a TCP segment going from the **Server to Client :**
A) [IPS, IPC, PC1, PS1] - Not valid because Src Port is shown to be PC1 which should have been PS1
B) [IPS, IPC, PS1, PC2] – Valid values because both the IP and port addresses match with the direction of the segment, going from the Server to the client.
C) [IPC, IPS, PS1, PC2] – Not a valid values because IP addresses are swapped.

4. **Only Sequence number is valid in all the TCP segments**. Because starting from the SYN segment to FIN segment, a given sequence number is valid. Whereas, if ACK bit is not set, Acknowledgement number is not valid. Especially when the first SYN segment is sent, there is no acknowledgment to be sent from the client. Similarly Urgent pointer is not set if the data is not carrying any urgent data to the other end.

Note: **Full 2 marks only if Sequence number is mentioned,** with a suitable explanation.
1.5 marks with a valid explanation, for mentioning both Seq no, Ack no. as the answers.

5. TCP is considered to be a reliable protocol because it guarantees data delivery through mechanisms like data sequencing, acknowledgments (ACK), retransmissions for the lost packets, and flow control. This ensures that data is transmitted accurately and delivered to the application in order, even though the L3 IP layer below it is unreliable and guarantees only a best effort delivery.

6. **A) It avoids any new incoming connections between the same set of hosts and ports.**
TIME_WAIT ensures that any delayed or duplicate segments from the closed connection are discarded and do not interfere with future connections that might reuse the same socket pair (IP address and port numbers). Also helps in receiving the delayed ACK from the other end, related to connection closure.

7. **socket.bind((HOST, PORT))**
This call associates the socket with a specific network interface and port number.
socket.listen()
This call tells the socket to start listening for incoming connection requests.

8. **PSH flag:**
The PSH (Push) flag in TCP is used to instruct the receiving TCP stack to immediately push any buffered data up to the application, rather than waiting to accumulate a larger segment of data. It

9.

1. First TCP segment: **From Host A to Host B**
    a. Sequence number: 101
    b. Length of TCP data transmitted: 60 Bytes
    c. Acknowledgement number: 301
    d. Window size: 2000 (its Rx buf is empty)
    e. Any associated control bits which are set: ACK = 1
2. Second TCP segment: **From Host B to Host A**
    a. Sequence number: 301
    b. Length of TCP data transmitted: 40 Bytes
    c. Acknowledgement number: 161
    d. Window size: 940 (its Rx buf is now filled with 60 bytes)
    e. Any associated control bits which are set: ACK = 1
3. Third TCP segment (only ACK, no data): **From Host A to Host B**
    a. Sequence number: 161
    b. Length of TCP data transmitted: 0 Bytes
    c. Acknowledgement number: 341
    d. Window size: **1960** (is Rx buf is now filled with 40 bytes)
    e. Any associated control bits which are set: ACK = 1

10.

a) Give the state transitions at Host A.

Both sides close at the same time:
ESTABLISHED → FIN_WAIT_1 → CLOSING → TIME_WAIT → CLOSED.

b) Give the state transitions at Host B.

Both sides close at the same time:
ESTABLISHED → FIN_WAIT_1 → CLOSING → TIME_WAIT → CLOSED.

c) What was the sequence number of the last byte of data received by the Host A?
ANS: L - 1

d) What was the sequence number of the last byte of data received by the Host B?
ANS: K - 1

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CIE-1 Question Paper – Set2 with Answer keys

Academic Year 2024-2025

Course: Network Security	**Course Code: CS3403**	**Semester: VI**
Date: 11 Feb 2025 **Duration: 70 minutes**	**Max Marks: 20**	

Sl. No.	Questions	Marks	L1-L6	CO
1.	Suppose computers A and B have IP addresses 10.120.**2**.114 and 10.120.2.125 respectively and they both use the same network mask N. Which of the values of N given below should not be used if A and B belong to the same network? A) 255.255.255.0 B)255.255.255.248 C)255.255.255.224 D)255.255.0.0	**2**	**L4**	**1**
2.	Which is the most optimal and the most suitable subnet mask for a subnet which is not going to have more than six hosts at any time in the future? Give all the valid host IDs in this subnet. Provide supporting explanation for your choice.	**2**	**L3**	**1**
3.	Assume two TCP connections are established from a Server with an IP address IPS to a Client machine with an IP address IPC. The TCP Port ID on IPS is PS1, and TCP Ports on the Client machine of these TCP connections are PC1 and PC2. Explanation is required. Choose the correct 4-tuple values [Src IP, Dest IP, Src Port, Dest Port] of one of the TCP segments going from the Client to the Server. A) [IPC, IPS, PC1, PS1] B) [IPS, IPC, PS1, PC2] C) [IPC, IPS, PS1, PC1]	**2**	**L3**	**1**
4.	Choose flag(s) shown below that consume(s) a sequence number and justify why is it required? Note: Supporting explanation is required. A) ACK B) SYN C) FIN	**2**	**L4**	**1**
5.	Describe the significance of the URG (Urgent) flag in TCP,	**1**	**L2**	**1**
6.	When an RST flag is received by a TCP host, what does it imply?	**1**	**L2**	**1**
7.	What does the below function do? What is the significance of the parameter 1024? data = socket.recv(1024)	**1**	**L3**	**1**
8.	How many bits wide are the port numbers in TCP and UDP? Give an example of a well-known port number.	**1**	**L2**	**1**

L1- Remember, L2- Understand, L3 – Apply, L4- Analyse, L5 – Evaluate, L6 – Create

Q9: CO1 L4 level **4 Marks**

The connection establishment between hosts A and B is as shown below. The buffer parameters and MTU values at each host at time = 0 are also given below. List of events **after time t=0** are:

a. After the connection establishment the Host A transmits the data first after t = 0.
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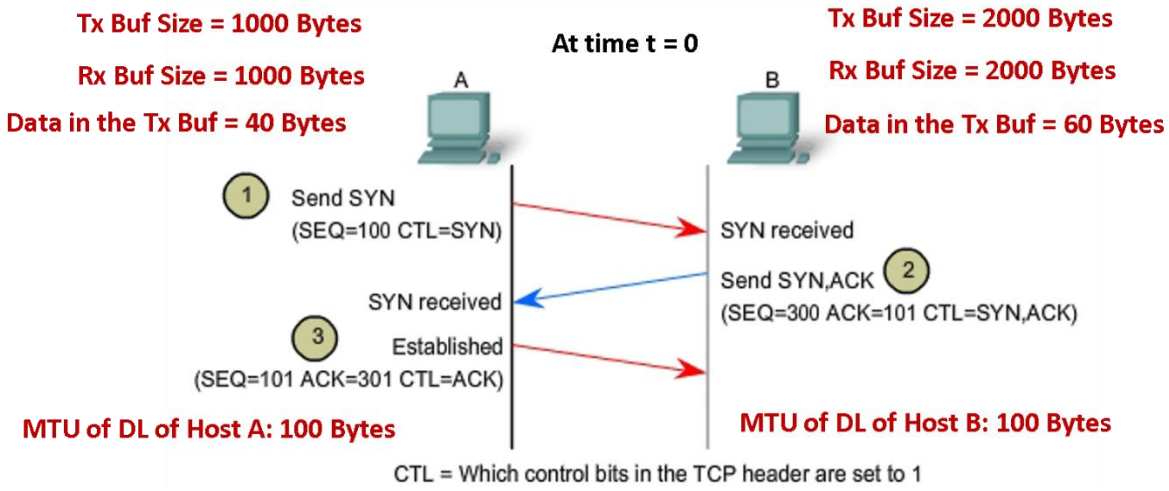
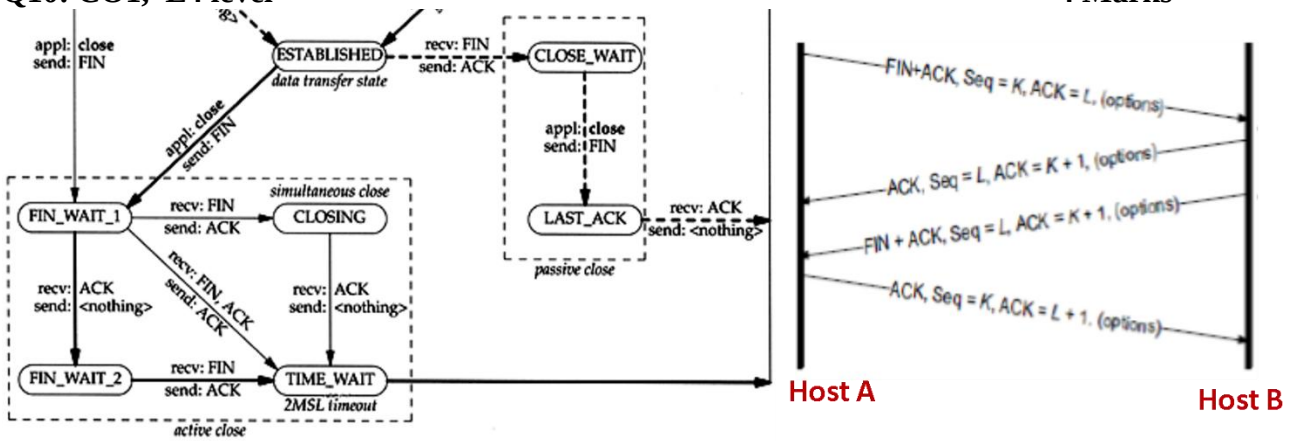


Give the following header values of **every TCP** segment that gets **transmitted** between the hosts in the **time order**, starting **from time = 0**, till all the data at the hosts get transmitted to other side. Give the direction of each TCP segment, either from **Host A to B or Host B to A**.

1. Sequence number 2. TCP data length 3. Ack number 4. Window size 5. CTL bits

Q10: CO1, L4 level **4 Marks**



a) Give the state transitions at Host A because of the message exchanges shown above.
b) Give the state transitions at Host B because of the message exchanges shown above.
c) What was the sequence number of the last byte of data sent by the Host A before closing?
d) What was the sequence number of the last byte of data sent by the Host B before closing?

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Option C 255.255.255.224 → FF.FF.FF.E0 yields the same Net ID 10.120.2.96
Option B: 255.255.255.248 → FF.FF.FF.F8 yields different Net IDs: 10.120.2.112 and 10.120.2.120
So, Option B 255.255.255.248 cannot be used as subnet mask.
Note: Without proper explanation no marks will be awarded even if the correct option is chosen.

2. For a subnet which is not going to have more than six hosts, need only maximum six valid IP addresses are required to be provided for the hosts in the subnet. The most **optimal** and **suitable subnet mask is the /29** which can accommodate **maximum six host addresses**, which will be sufficient for the hosts in it.
   Subnet mask → **/29** → 255.255.255.248 → 0xFF.FF.FF.F8 - **1 mark (including for the explanation)**
   valid host IDs are 1 to 6 – 1 mark

3. **A is the correct option.**

The 4-tuple values are: [Src IP, Dest IP, Src Port, Dest Port] of a TCP segment going from the **Client to Server :**
A) **[IPC, IPS, PC1, PS1]** - Valid because both the IP and Port addresses match with the direction of the segment going from the client to server.
B) **[IPS, IPC, PS1, PC2]** – Not valid because both IP addresses and port numbers do not match with the direction of movement of the segment.
C) **[IPC, IPS, PS1, PC1]** – Also not a valid values because port numbers are misplaced.

4. **Both SYN** and **FIN** flags consume a Sequence number because both have to be made sure by the sender that it reaches the other end. If the sender does not get an ACK for these flags, it retransmits them. This is done to make sure that the other end is aware of connection request (in case SYN flag) and the termination of the existing connection (in case of FIN flag).
   Note: ACK flags do not consume a sequence number. ACK segments are not retransmitted if they get lost. The next data when sent the ACK bit and the updated Acknowledgement number takes care of the lost ACK segment.

5. The **URG (Urgent)** flag in TCP is used to indicate that the data in the segment is urgent and should be prioritized for immediate processing. It works in conjunction with the Urgent Pointer, which specifies the last byte of urgent data in the segment, allowing it to bypass normal data processing and be delivered immediately to the application layer. The sender will not wait for the entire byte stream to be transmitted which is ahead of the urgent data. It is also called, out-of-band data.

6. **RST Flag**: The sender will not wait for the entire byte stream to be transmitted which is ahead of the urgent data. It is also called, out-of-band data.
7. **socket.recv(1024)** is a blocking call to receive any data coming from the other end of the socket connection. 1024 significs the maximum Rx buffer size reserved for receiving the data.

The socket.recv(1024) call in Python attempts to read up to 1024 bytes of data from the socket's receive buffer. If the socket is in blocking mode, the call will wait until at least some data is available before returning; if no data is available and the connection is closed, it returns an empty bytes object. The number 1024 specifies the maximum amount of data (in bytes) to retrieve in one call, but the actual amount received may be less than 1024 bytes

8. Port number in both TCP and UDP are 16 bits wide. – **0.5 marks**
   80: HTTP, 23: Telnet , 20-21: FTP. – **0.5 marks**
   Note: Any one example well-known port number is sufficient.

9.
   - **a.** First TCP segment: **From Host A to Host B**
     i. Sequence number: 101
     ii. Length of TCP data transmitted: 40 Bytes
     iii. Acknowledgement number: 301
     iv. Window size: 1000
     v. Any associated control bits which are set: ACK = 1
   - **b.** Second TCP segment: **From Host B to Host A**
     i. Sequence number: 301
     ii. Length of TCP data transmitted: 60 Bytes
     iii. Acknowledgement number: 141
     iv. Window size: 1960
     v. Any associated control bits which are set: ACK = 1
   - **c.** Third TCP segment (only ACK, no data): **From Host A to Host B**
     i. Sequence number: 141
     ii. Length of TCP data transmitted: 0 Bytes
     iii. Acknowledgement number: 361
     iv. Window size: 940
     v. Any associated control bits which are set: ACK = 1

10.
   a) ESTABLISHED → FIN_WAIT_1 → FIN_WAIT_2 → TIME_WAIT → CLOSED.
   b) ESTABLISHED → CLOSE_WAIT → LAST_ACK → CLOSED.
   c) K-1
   d) L-1

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