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Internal Assessment Test 2 – December 2021

Sub:	Computer Networks and Security					Sub Code:	18CS52	Branch:	ISE	
Date:	16/12/2021	Duration:	90 min's	Max Marks:	50	Sem/Sec:	V A, B & C		OBE	

	Answer any FIVE FULL Questions	MARKS	CO	RBT
1	Build a Reliable Data Transfer Protocol to satisfy following conditions • Stop and wait protocol. • Packet contains sequence number, data and checksum. • Need to use both ACK and NACK. • Need to handle duplicates.	[10]	CO2	L3
2	Design a FSM for the protocol which retransmits every packet from the last ACK after timeout event.	[10]	CO2	L2
3a)	Draw the Connection Oriented Protocol segment structure and explain.	[7]	CO2	L2
3b)	Explain about steps involved in communication via Virtual Circuit Network (VCN) in network layer.	[3]	CO3	L1
4a)	How does connection establishment and connection termination occur in connection oriented protocol?	[7]	CO2	L1
4b)	Differentiate between ACK and SYN in connection oriented communication with example.	[3]	CO2	L2

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6 (a)	Draw and explain IPv4 datagram format.	[7]	CO3	L1
6(b)	List and describe 3 types of switching fabric.	[3]	CO3	L1

Faculty Signature CCI Signature HOD Signature

5	Design communication flow for reliable data transfer in following situations (vi) Retransmission due to lost ACK (vii) Sending multiple packets back-to-back (viii) Avoiding retransmission by cumulative ACK (ix) Fast retransmit (x) Slow start	[10]	CO2	L3
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Scheme of Evaluation Internal Assessment Test 2 – December 2021

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Note: **Answer Any five full questions.**

Question #		Description	Marks Distribution		Max Marks
1		Build a Reliable Data Transfer Protocol to satisfy following conditions • Stop and wait protocol. • Packet contains sequence number, data and checksum. • Need to use both ACK and NACK. Need to handle duplicates. **Diagram** **Explanation**	6M+4M	10M	10M
2		Design a FSM for the protocol which retransmits every packet from the last ACK after timeout event. **FSM Diagram** **Protocol Explanation**	6M 4M	10M	10M
3	a)	Draw the Connection Oriented Protocol segment structure and explain. **Packet Diagram** **Explain each field**	4M 3M	7M	10M

3	b)	Explain about steps involved in communication via Virtual Circuit Network (VCN) in network layer. **Listing Steps** **Explanation**	 1M 2M	3M	
4	a)	How does connection establishment and connection termination occur in connection oriented protocol? connection establishment flow diagram **Explanation** connection termination flow diagram **Explanation**	 **2.5M** **1M** 2.5M 1M	7M	10M
4	b)	Differentiate between ACK and SYN in connection oriented communication with example. Explanation with Example	 1.5M+ 1.5M	3M	
5	a)	Design communication flow for reliable data transfer in following situations (i) Retransmission due to lost ACK. (ii) Sending multiple packets back-to-back. (iii) Avoiding retransmission by cumulative ACK. (iv) Fast retransmit. (v) Slow start **Explanation** **FSM Diagram**	 4M 6M	10M	10M

6	a)	Draw and explain IPv4 datagram format. **Explanation** **Packet format**	 3M 4M	 7M	10M
6	b)	List and describe 3 types of switching fabric. **Listing 3 types** **Explanation**	 1M 2M	 3M	

Scheme Of Evaluation Internal Assessment Test 2 – December 2021

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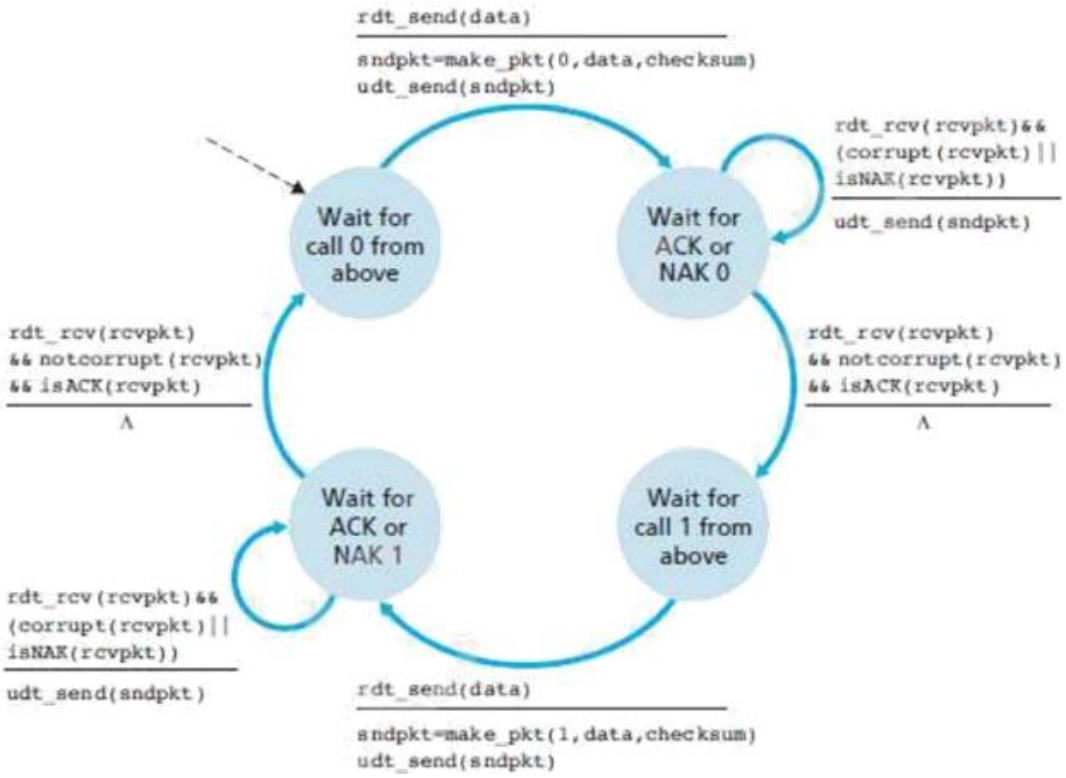
Date:	16/12/2021	Duration:	90mins	Max Marks:	50	Sem:	V	Branch:	ISE

Note: **Answer Any full five questions**

Q. 1 Build a Reliable Data Transfer Protocol to satisfy following conditions

- **Stop and wait protocol.**
- **Packet contains sequence number, data and checksum.**
- **Need to use both ACK and NACK.**
- **Need to handle duplicates.**



Problem with rdt2.0: If an ACK or NAK is Corrupted, the sender cannot know whether the data is received or not.

Solution: The sender resends the current data packet when it receives garbled ACK or NAK packet.

Problem : This approach introduces duplicate packets into the channel.

Solution : Add sequence-number field to the data packet.

The receiver has to only check the sequence-number to determine whether the Received packet is a retransmission or not. For a stop-and-wait protocol, a 1-bit sequence-number

will be sufficient.

• A 1-bit sequence-number allows the receiver to know whether the sender is sending previously transmitted packet {0} or new packet (1).

• We call this protocol as rdt2.1

Q.2 Design a FSM for the protocol which retransmits every packet from the last ACK after timeout event.

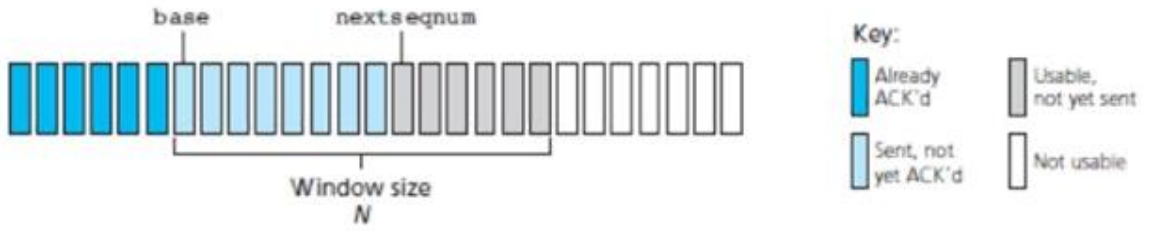
It is GoBack-N protocol.

• The sender is allowed to transmit multiple packets without waiting for an acknowledgement

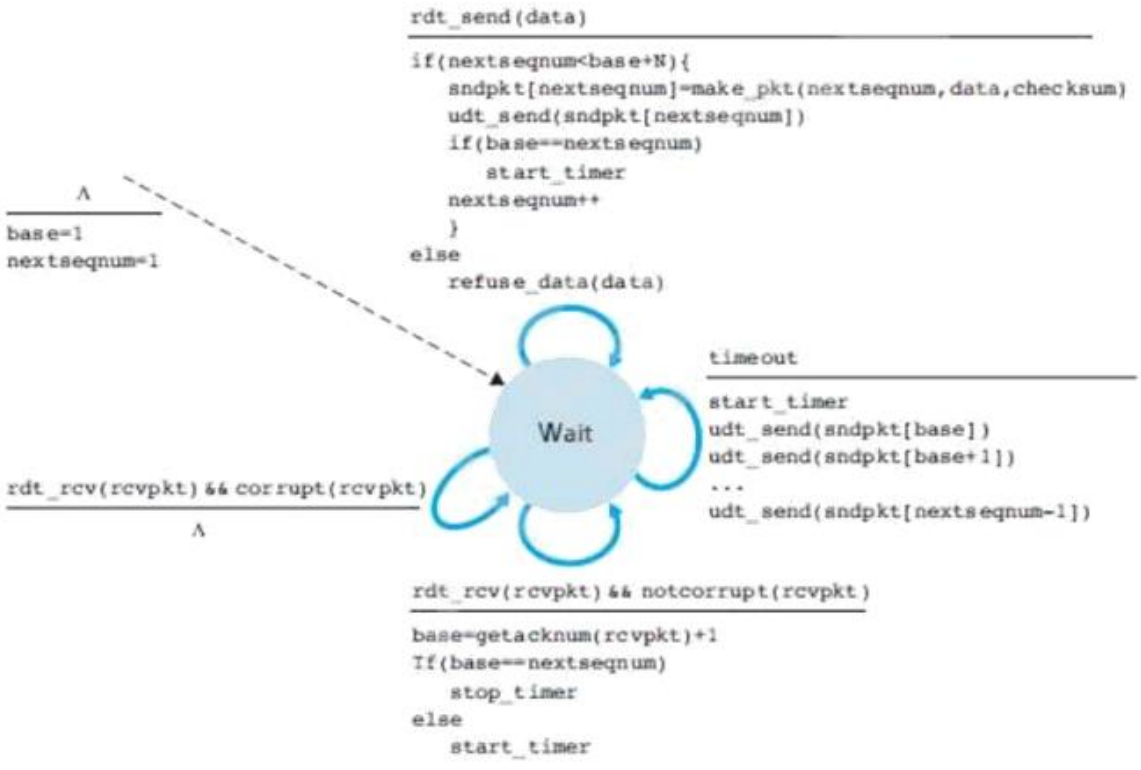
• But, the sender is constrained to have at most N unacknowledged packets in the

Where N -window-size which refers maximum no. of unacknowledged packets in the pipeline

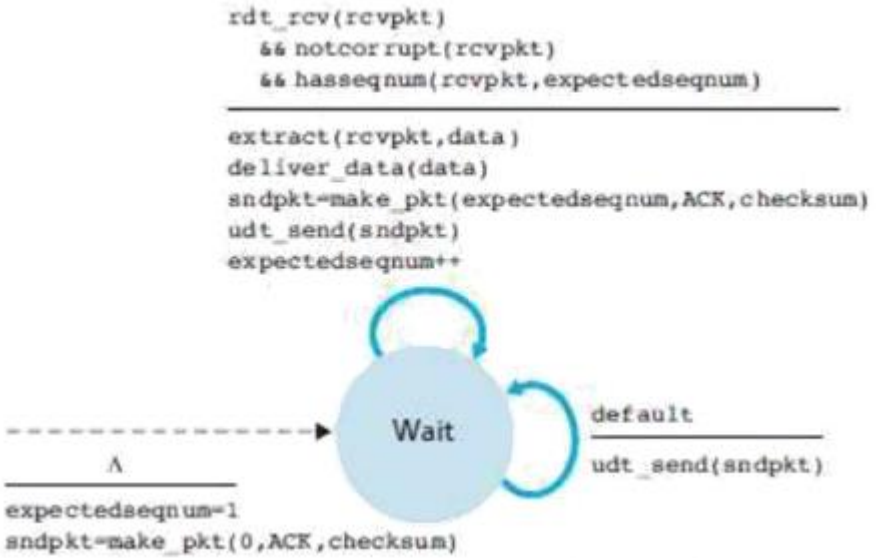
• GBN protocol is called a sliding-window protocol.



Sender's view of sequence-numbers in Go-Back-N

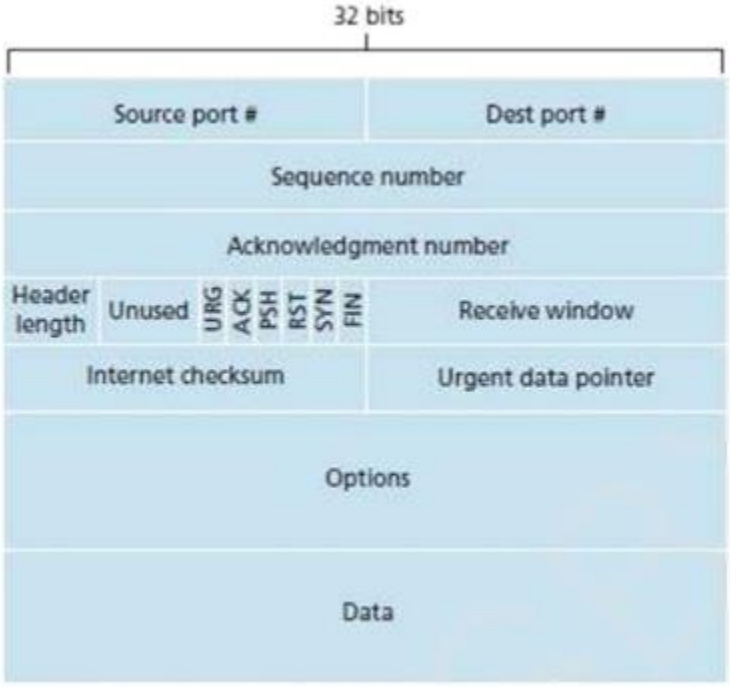


Extended FSM description of GBN sender



Extended FSM description of GBN receiver

Q.3 a) Draw the Connection Oriented Protocol segment structure and explain..



TCP segment structure

• The segment consists of header-fields and a data-field.
• The data-field contains a chunk of-data.
• When TCP sends a large file, it breaks the file into Chunks of size MSS.

• The fields of TCP segment are as follows:
1) **Source and Destination Port Numbers:** These fields are used for multiplexing/demu1tiplexing data from/to upper-layer applications.
2) **Sequence Number & Acknowledgment Number:** These fields are used by sender & receiver in implementing a reliable data-transfer-service.
3) **Header Length:** This field specifies the length of the TCP header.
4) **Flag:** This field contains 6 bits.
i} **ACK** This bit indicates that value of acknowledgment field is valid.
ii) **RST, SYN & FIN**: Th ese bits are used for connection setup and teardown .
iii) **PSH:** This bit Indicates the sender has invoked the push operation.
iv) **URG:** This bit indicates the segment contains urgent-data.
5) **Receive Window:** This field defines receiver's window size This field is used for low control.
6) **Checksum:** This field is used for error-detection.
7) **urgent Data Pointer:** This field indicates the location of the last byte of the urgent data.
8) **Options:** This field is used when a sender & receiver negotiate the OSS for use in high-speed networks.

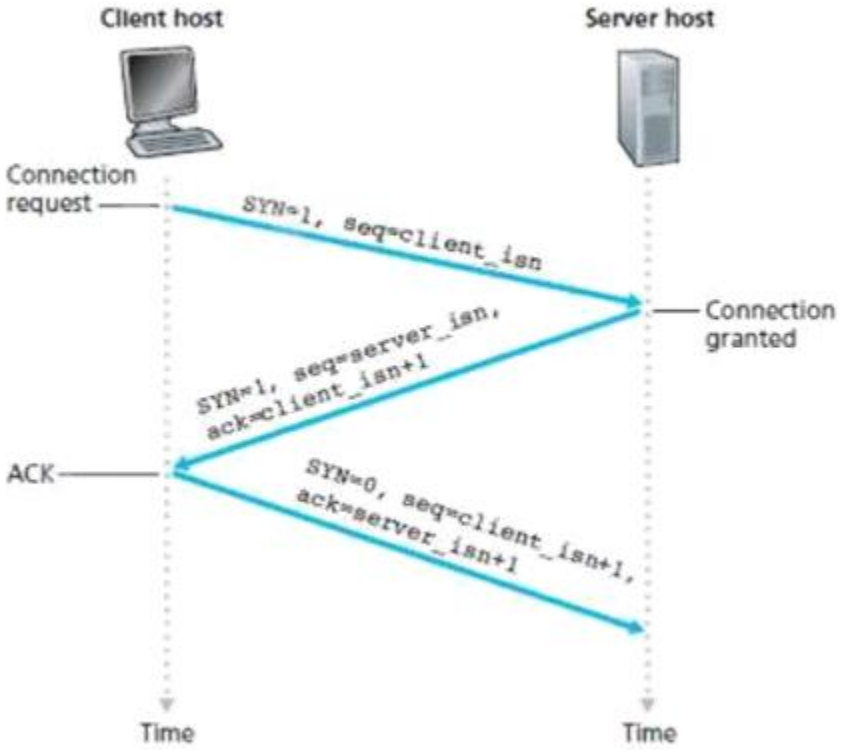
Q.3 b) **Explain about steps involved in communication via Virtual Circuit Network (VCN) in network layer.**

• A VC consists of
1) A path between the source and destination.
2) VC number: This is one number for each link along the path.
3) Entries in the forwarding-table in each router.

• A packet belonging to a virtual-circuit will carry a VC number in its header.
• At intervening router, the VC number of traversing packet is replaced with a new VC number.
• The new VC number is obtained from the forwarding-table.

Virtual—circuit setup
VC setup is simplified by permitting a different VC number at each link along the path.
• **Disadvantage:**
The routers must maintain connection srate information for the ongoing connections.
• Three phases in a virtual-circuit
1) VC Setup
• During the setup phase, the sending transport-layer
— contacts the network-layer
—• specifies the receiver's address and waits for the network to set-up the VC.
The network-Iayer determines the path between sender and receiver.
The network-layer also determines rhe VC number for each link along the path. Finally, the network-layer adds an entry in the forwarding-table in each router.
• During VC setup, the network-layer may also reserve resources.
2) Data Transfer
Once the VC has been established, packets can begin to flow along the VC.
3) VC Teardown
This is initiated when the sender/receiver wants to terminate the VC. The network-layer
—. informs the other end-system of the call termination and
removes the appropriate entries in tne forwarding -table in each router.

4. How does connection establishment and connection termination occur in connection oriented protocol?



TCP three-way handshake: segment exchange

Connection Setup & data Transfer

- To setup the connection, three segments are sent between the end hosts. The referred to as a three-way handshake.
- Suppose a client-process wants to initiate a connection wirh a server-process.
- Step 1: Client sends a connection-request segment to the Server The client first sends a connection-request segment to the server.
- The connection-request segment contains:
- 1) SYN bit is set to 1.
- 2) ZnitiaI sequence -number (clients.isn}.
- The SYN segment is encapsulated within an TCP datagram and sent to the server.
- Step 2: Server sends a connection-granted segment to the Client Then, the server
- extracts th e SYN segment from the datagram allocates the buffers and variables to the connection and sends a connection-granted segment to the client.

Th e connection-granted segment contains:

1) SYN bit is set to 1.

2) Acknowledgment field is set to cIient_isn +1.

3) Initial sequence -number (server_isn).

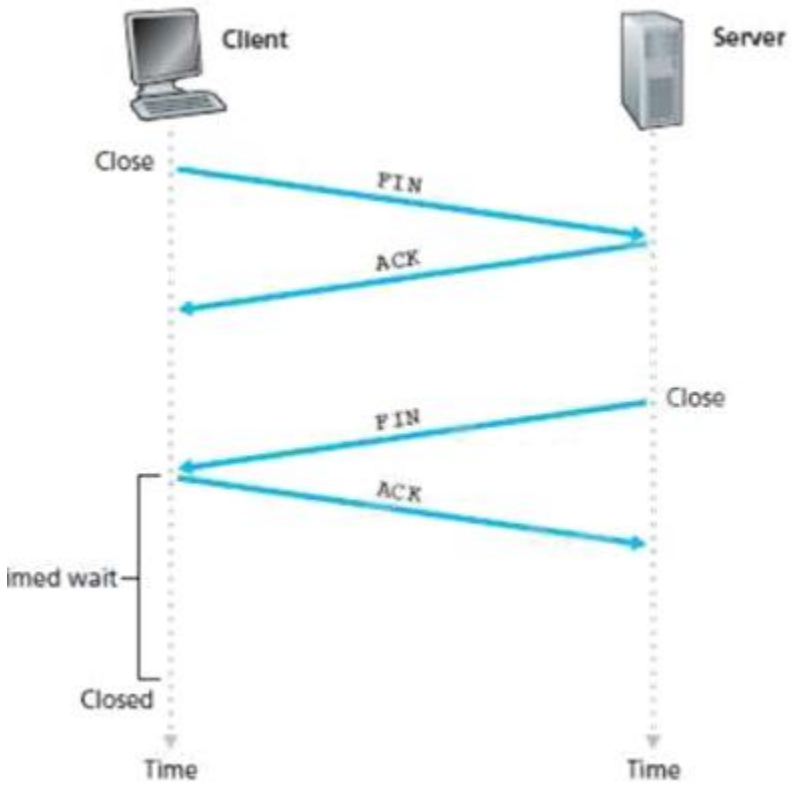
Step 3: Client sends an ACy segment to the Server

Finally, the client

allocates buffers and variables to tne connection and

sends an ACK segment to the server Th e ACK segment acxnowledges the server.

SYN bit is set to zero, since the connection is established.



Closing a TCP connection

Connection Release

• Either of the two processes in a connection can end the connection.

• When a connection ends, the “resources’£ in the hosts are de -allocated.

• Suppose the client decides to close the connectir›n .

1) The client-process issues a close command.

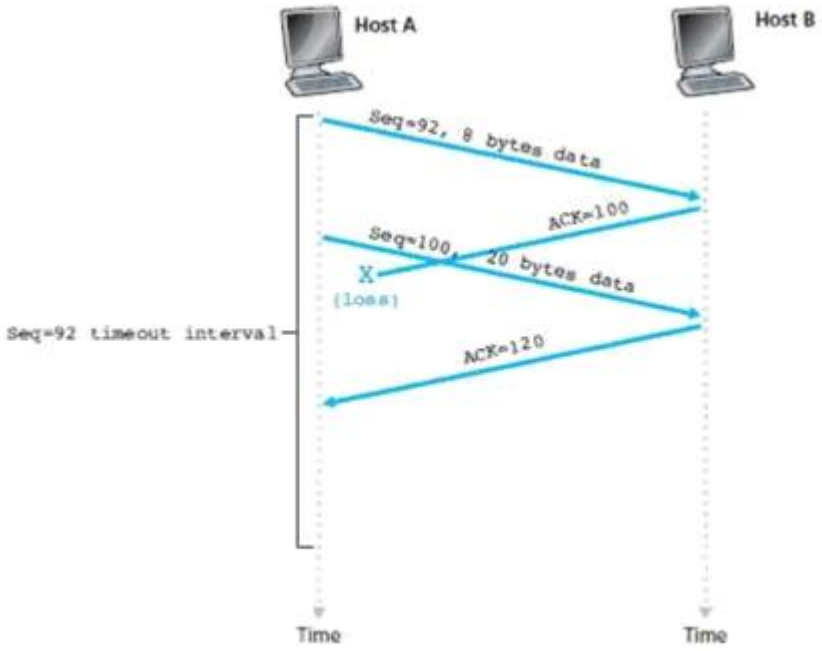
Then, the client sends a shutdown-segment to the server. x Th is segment has a FIN bit set to 1.

2) The server responds with an acknowledgment to th e client.

3) The server then sends its own shutdown-segment. x This segment has a FIN bit set to 1.

4} Finally, the client acknowledges the server's shutdown-segment.

4. b) Differentiate between ACK and SYN in connection oriented communication with example.



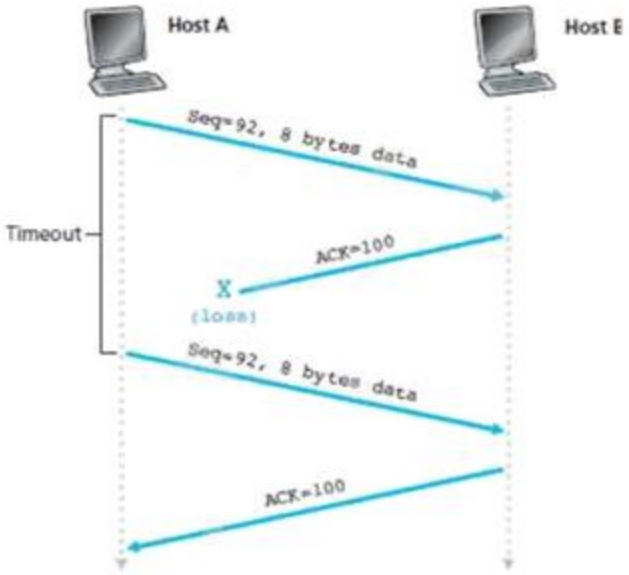
Flow dig to show ACK and SEQ

- ACK is the number of next expecting packet, in the above example, ACK= 100 is the packet number 100 that is expected, next iteration the packet with SEQ number 100 is sent.
- SYN is the term used in order to ask end users to wait for reply from other end user before sending next packet.

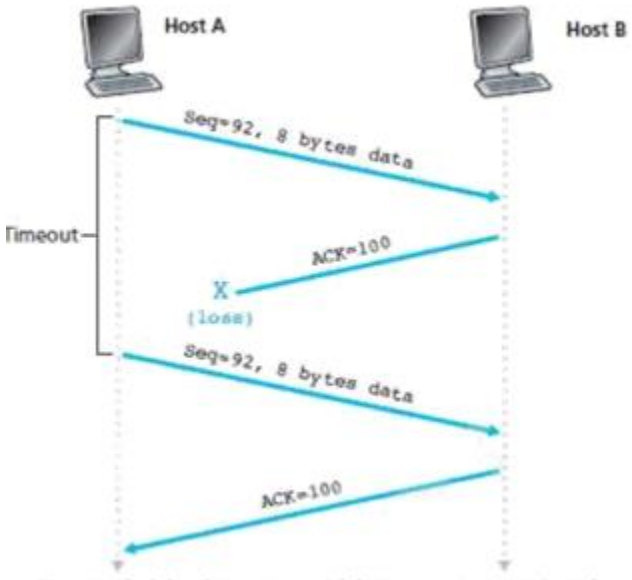
5. Design communication flow for reliable data transfer in following situations

(i) Retransmission due to lost ACK.
(ii) Sending multiple packets back-to-back.
(iii) Avoiding retransmission by cumulative ACK.
(iv) Fast retransmit.
(v) Slow start.

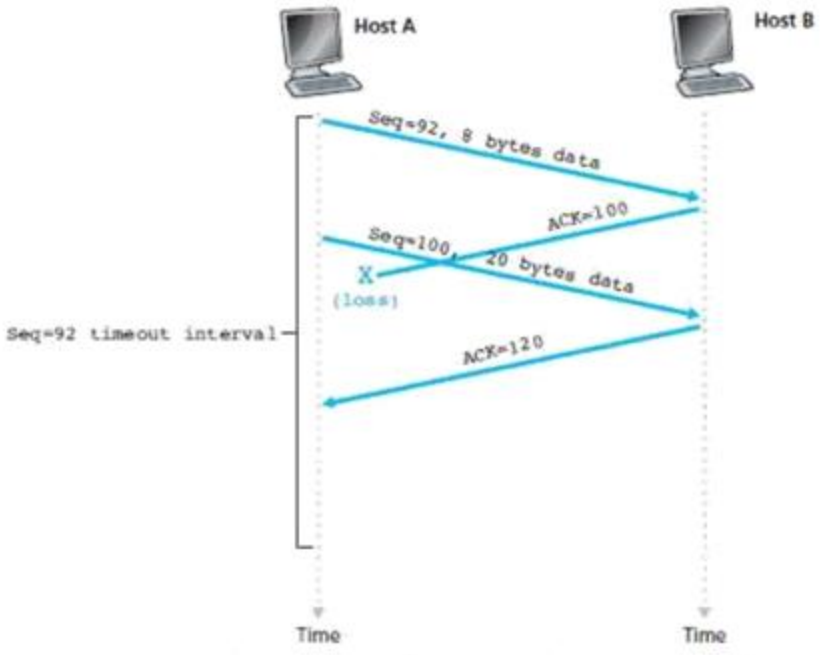
(i)



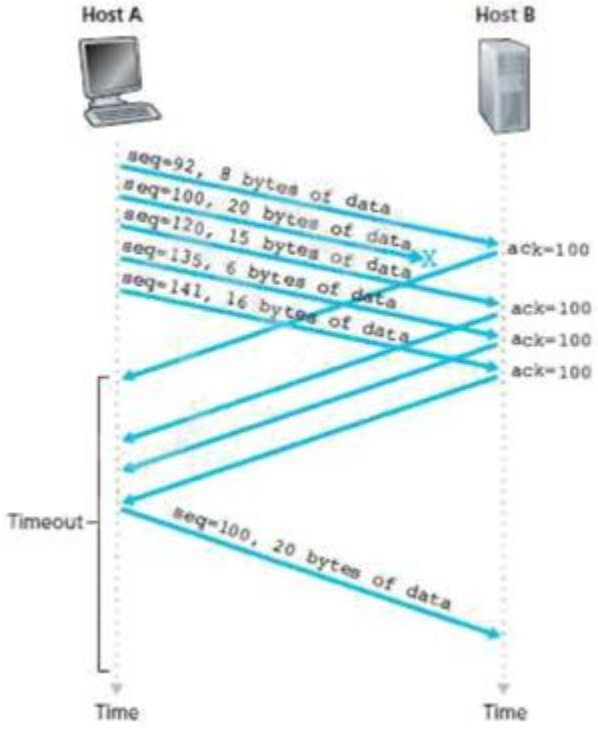
(i) Retransmission due to lost ACK.



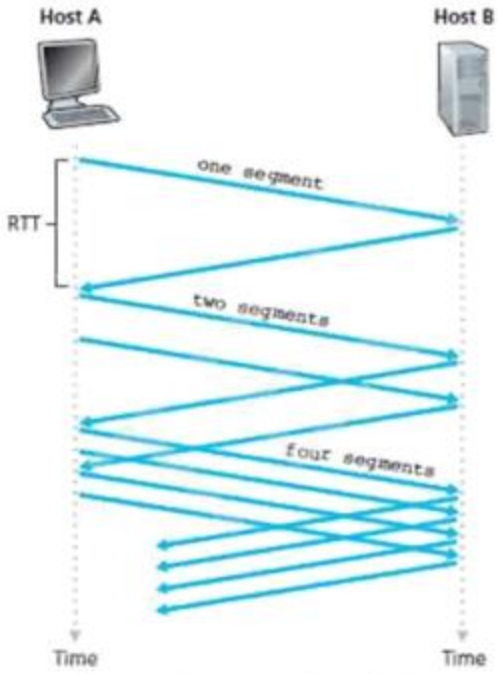
(ii) Sending multiple packets back-to-back.



(iii) Avoiding retransmission by cumulative ACK.

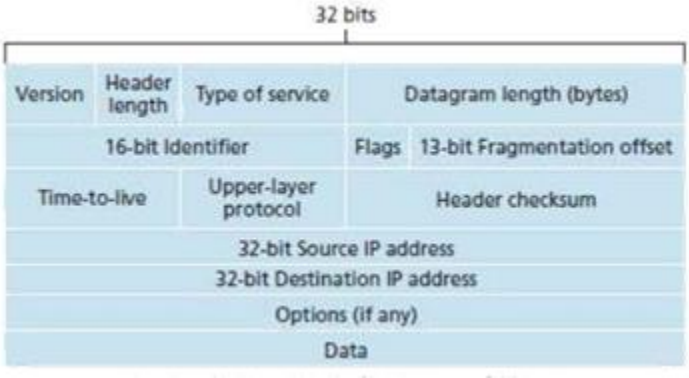


(iv) Fast Retransmit



(v) Slow Start

6 a) Draw and explain IPv4 datagram format.



IPv4 datagram format

Payload (or Data): This field contains the data to be delivered to the destination.
Header: Header Contains information essential to routing and delivery.
Version: This field specifies version of the 1Pv4 datagram, i.e. 4.
Header Length: This field specifies length of header.Without options field, header-ten gLh = 5 bytes.
Type of Service (TOS): This field specifies priority of packet based on parameters such as delay, throughput, reliability & cost.
datagram Length: This field specifies the total length of the datagram {header + data).
Maximum length = 6553d bytes.
Identifier, Flags, Fragmentation Offset
These fields are used for fragmentation and reassembly.
Fragmentation occurs when the size of the data9ram is larger than the MTU of the network.
i**) Identifier**: This field uniquely identifies a datagram packet.

ii) **Flag•:** It is a 3-bit field. The first bit is not used.
The second bit D is called the do not fragment bit. The third bit M is called the more fragment bit.
iii} **fragmentation Offset:** This field identifies location of a fragment in a datagram.
6) Time-To-Live (TTL): This defines lifetime of the datagram (default value 64) in hops. Each router decrements TTL by 1 before forwarding. If TTL is zero, the datagram is discarded.
7) Protocol: This field specifies upper-layer protocol used to receive the datagram at the destination-nost. For example, TCP=6 and UDP= 17.
8) Header Checksum: • This fiend is u sed to verify integrity of header. If the verification process fails, the packet is discarded.
9**) Source IP Address & destination IP Address**
These fields contain the addresses of source and destination respectively.
10} Options
This field allows the packet to requ est special features such as
— security level
—• route to be taken by packet at each router.

6 b) List and describe 3 types of switching fabric.

Switching via Memory

• Switchin g b/w input-ports & output-ports is done under direct control of CPU i. e. routing processor.
• Input and output-ports work like a tradition al t/O devices in a computer.
i) On arrival of a packet, the input port n otifies the routing-processor via an interrupt.
ii) Then, the packet is copied from the input-port to processor-memory.
iii} Finally, the routin g-processor extracts the destination-address from the header looks up the appropriate output-port in the forwarding-table and copies the packet into the output -port's buffers.
• Let memory-bandwidth = B packets per second.
Thus, the overall forwarding throughput must be less th an B/2.

Switching via a Bus
• Switchin g b/yv input-p0rts & output-ports is done without intervention by the routing-processor.
i) The input-port appends a switch-internal label (header) Lo the packet.
• Th e label indicates the local output-port to which the packet must be transferred. Then, the packet is received by all output-ports.
• But, only th e port that matches the label will keep the packet.
iii) Finally, the label is removed at the output-port.

Switching via an Interconnection Network
A crossbar switch is an interconnection nettwork.
• The network consists of 2N buses that connect N input-ports output-ports.
• Each vertical bus intersects each horizontal bus at a Crosspoint.
• The crosspoint can be opened or closed at an y time by the switch-controller.
1) To move a packet from port A to port Y, the switch -controller closes the crosspoint at the intersection of buses A and Y.
2) Then, port A sends the packet onto its bus, which is picked up by bus Y.