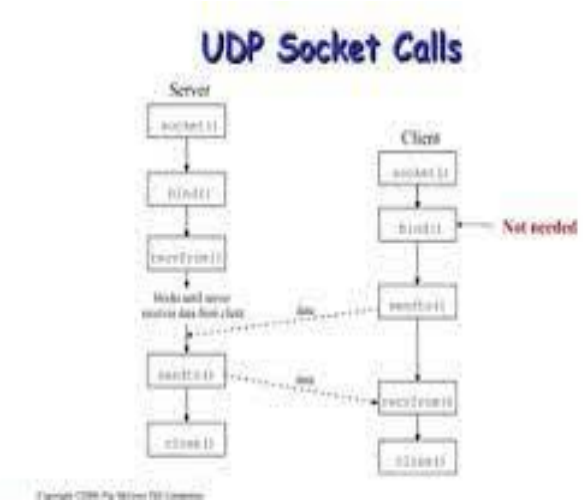
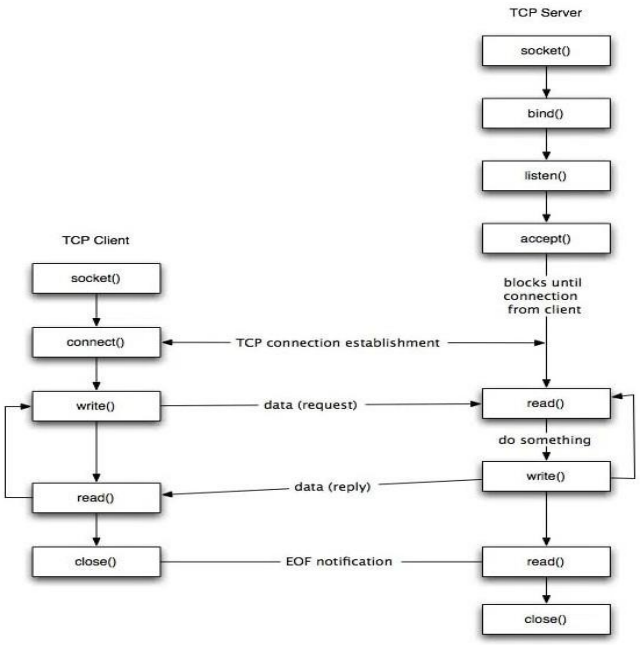
Q. No	SET-D Answer with choice variable
1	RPC provides a(an) _____ on the client-side, a separate one for each remote procedure. a. **stub** b. identifier c. name d. process identifier
2	Which of the following is false with respect to UDP? a. **Connection-oriented** b. Unreliable c. Transport layer protocol d. Low overhead
3	An iterative server has lower _____ compared to a concurrent server. a. **complexity** b. latency c. cpu and memory requirements d. network overhead
4	As the sending and the receiving processes may not write or read data at the same speed, TCP_____ a. slows down the faster process b. uses timers c. **uses buffers** d. speeds up the slower process
5	In the Output Processing Module, what action is typically taken if the sender's buffer is full, and it cannot send additional data? a. The data is discarded. b. The data is fragmented into smaller segments. c. **The sender waits until space becomes available in the buffer.** d. The connection is closed immediately.
6	The System in which the names are defined in an inverted-tree structure with the root at the top is called a.Name Space b.**Domain Name Space** c.Hierarchical Name Space d.Flat Name Space
7	The HTTP response message leaves out the requested object when _____ method is used a) GET b) POST c) **HEAD** d) PUT
8	When using IMAP, where are the emails stored? A) Emails are downloaded and stored locally on the device. B) Emails are stored only on the server. C) E**mails are stored both on the server and locally on the device.** D) Emails are encrypted during transmission.
9	SMTP is not used to deliver messages to _____ a) user's terminal b) user's mailbox c) **user's word processor** d) user's email client
10	The Uniform Resource Locator (URL), is a standard for specifying any kind of information on the

	a) server-end b) client-end c) web page **d) internet**	
11	Imagine you are a network administrator responsible for setting up communication between two devices over a UDP network. Explain the fundamental system calls that need to be utilized to establish UDP communication between these devices with a suitable snippet.  Socket Creation (socket): The server creates a UDP socket using the socket() system call to specify the communication protocol (typically AF_INET for IPv4 and SOCK_DGRAM for UDP). Binding (bind): The server binds the socket to a specific IP address and port number using the bind() system call. This associates the server with a specific network interface and port for receiving UDP packets. Data Reception (recvfrom): The server uses the recvfrom() system call to receive data from clients. This call also provides information about the source (client) address and port. Data Processing: The server processes the received data as needed, which may involve various application-specific operations. Socket Closure (close): After communication or when the server is done, it closes the socket using the close() system call to release resources. UDP Client:	10

	Socket Creation (socket): The client creates a UDP socket using the socket() system call, similar to the server. Data Transmission (sendto): The client uses the sendto() system call to send data to the server. This call includes the destination (server) address and port. Data Reception (recvfrom): The client can use the recvfrom() system call to receive data from the server, if needed, following a similar pattern to the server's data reception. Socket Closure (close): After communication or when the client is done, it closes the socket using the close() system call to release resources.	
12	Describe how fork () system call is going to help in handling multiple clients concurrently. Give a sample snippet. The fork() system call creates copies of a program, useful for handling multiple clients concurrently in server applications.The system calls' aid in handling multiple clients are described below: Client acceptance: When a server application starts,a socket and listens for incoming connections using listen() and accept() system calls. When a client connects, the server uses accept() to accept the connection. Concurrent Handling: The child process, being an exact duplicate of the parent, inherits the socket descriptor associated with the client connection. Both the parent and child processes can now independently communicate with the client over the same connection. Parallel Processing: The parent process can continue listening for new connections, and each time a new client connects, it can fork a new child process. Client-Specific Processing: Each child process can handle a specific client's requests independently. Note: Students can give any relevant program using fork function.	10
13	In TCP, consider the scenario where a client connects to the server and sends the message "Hello, Server!". The server should then broadcast this message to all connected clients. Describe the sequence of function calls and the communication flow for this scenario.	10



Note: Students need to describe each stages of the flow chart.

14 Explain the features & services of SCTP protocol with suitable examples. 10

SCTP (5 marks)

Association establishment/data transfer/termination (5 marks)

Stream Control Transmission Protocol (SCTP) is a transport-layer protocol that ensures reliable, in-sequence transport of data. SCTP provides multihoming support where one or both endpoints of a connection can consist of more than one IP address. This enables transparent failover between redundant network paths. It is similar to TCP, but provides message-oriented data transfer, similar to **UDP.** SCTP, however, is mostly designed for Internet applications that have recently been introduced. These new applications, such as IUA (ISDN over IP), M2UA and M3UA (telephony signaling), H.248 (media gateway control), H.323 (IP telephony), and SIP (IP telephony), etc.

SCTP combines the best features of UDP and TCP. SCTP is a reliable message-oriented protocol. It preserves the message boundaries, and at the same time, detects lost data, duplicate data, and out-of-order data. It also has congestion control and flows control mechanisms..

Features of SCTP

There are various features of SCTP, which are as follows −

Transmission Sequence Number

The unit of data in TCP is a byte. Data transfer in TCP is controlled by numbering bytes by using a sequence number. On the other hand, the unit of data in SCTP is a DATA chunk that

may or may not have a one-to-one relationship with the message coming from the process because of fragmentation.

Stream Identifier

In TCP, there is only one stream in each connection. In SCTP, there may be several streams in each association. Each stream in SCTP needs to be identified by using a stream identifier (SI). Each data chunk must carry the SI in its header so that when it arrives at the destination, it can be properly placed in its stream. The 51 is a 16-bit number starting from O.

Stream Sequence Number

When a data chunk arrives at the destination SCTP, it is delivered to the appropriate stream and in the proper order. This means that, in addition to an SI, SCTP defines each data chunk in each stream with a stream sequence number (SSN).

Packets

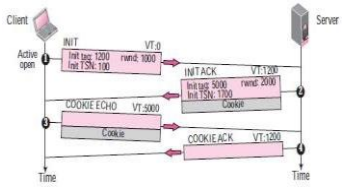
In TCP, a segment carries data and control information. Data is carried as a collection of bytes; control information is defined by six control flags in the header. The design of SCTP is totally different: data is carried as data chunks; control information is carried as control chunks.

SCTP Client Server Association

Four-way handshake

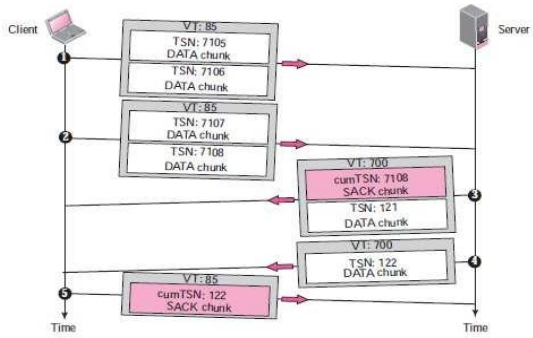
1. First packet has INIT chunk sent by client
   - Verification tag is 0
   - Rwnd is advertised in a SACK chunk
   - Inclusion of a DATA chunk in the third and fourth packets
2. Second packet has INIT ACK chunk sent by server
   - Verification tag is the initial tag field in the INIT chunk
   - Initiates the tag to be used in the other direction
   - Defines the initial TSN and sets the servers' rwnd
3. Third packet has COOKIE ECHO chunk sent by client
   - Echoes the cookie sent by the server
   - Data chunks are included in this packet
4. Fourth packet has COOKIE ACK chunk sent by server

- Acknowledges the receipt of the COOKIE ECHO chunk
- Data chunks are included with this packet.



SCTP data transfer

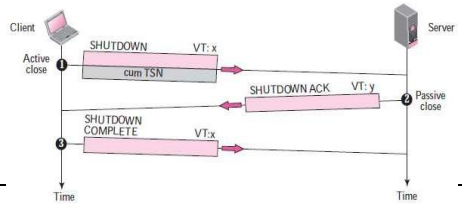
- Purpose of an association is to transfer data
- between two ends.
- Once association is established, bidirectional data transfer can take place.
- SCTP supports piggybacking.
- Each message coming from the process is treated as one unit and inserted into a DATA chunk.
- Each DATA chunk formed by a message or a fragment has one TSN and acknowledged by SACK chunks.



SCTP Association termination

The Association termination in a SCTP is done by sending three packets between a client and a server

- SHUTDOWN
- SHUTDOWN ACK
- SHUTDOWN COMPLETE



15	i. A DNS client is looking for the IP address of xxx.yyy.com. Show the query message with values for each field. (5M) ii. Show the response message of a DNS server for the above query message. Assume the IP address is 201.34.23.12. (5M) i. DNS query message when a DNS client is looking for the IP address of xxx.yyy.com: DNS Header: ID: A unique identifier for the query (e.g., 0x1234). QR: 0 (Query) - Indicates that this is a query. Opcode: 0 (Standard Query) - Specifies a standard DNS query. AA: 0 (Authoritative Answer) - Not authoritative. TC: 0 (Truncation Flag) - Not truncated. RD: 1 (Recursion Desired) - Requesting recursive resolution. RA: 0 (Recursion Available) - Indicates whether recursive resolution is available. Z: 0 (Reserved) - Reserved for future use. RCODE: 0 (Response Code) - No error condition. Question Section: QNAME: "xxx.yyy.com" - The domain name being queried. QTYPE: A (Address) - Requesting an IPv4 address. QCLASS: IN (Internet) - The class of the query, indicating the Internet. ii. Show the response message of a DNS server for the above query message. Assume the IP address is 201.34.23.12. DNS response message for the query: DNS Header: ID: Same as in the query QR: 1 (Response) Opcode: 0 (Standard Query) AA: 1 (Authoritative Answer) TC: 0 (Not Truncated) RD: 1 (Recursion Desired)	10

	RA: 1 (Recursion Available) RCODE: 0 (No error) Answer Section: NAME: "xxx.yyy.com" TYPE: A (IPv4 Address) CLASS: IN (Internet) TTL: Time To Live RDLENGTH: 4 RDATA: 201.34.23.12 This is a simplified representation of a DNS response message, indicating that the IP address for xxx.yyy.com is 201.34.23.12.	
16	Imagine Priya, a graphic designer, is tasked with sending a large design project file to her client Raju, who is located in a different city. Develop a comprehensive plan that outlines the steps for using FTP (File Transfer Protocol) to securely and efficiently transfer the file. In your plan, consider factors such as file organization, user authentication, and any potential challenges or contingencies that may arise during the FTP file transfer process. FTP File Transfer Plan for Priya to Raju: File Organization: Compress project files into a single archive. User Authentication: Use valid FTP client; obtain server credentials from Raju. Encryption: Prioritize FTPS or SFTP for secure transfer. Uploading Files: Connect, navigate, and upload to the server. Download Confirmation: Raju confirms successful download. File Extraction: Raju extracts files locally. Data Backup: Maintain a local backup. Monitoring: Watch for errors, resume if interrupted. Notification: Notify Raju upon completion. Post-Transfer Security: Secure or delete files locally. Follow-up: Maintain open communication with Raju for further project needs.	10

17	Analyze the situation of Raju, a business owner needing to send an important email to his client using his email client software. Could you explain the significance of SMTP in enabling him to send emails, detail the mechanism of how SMTP works for sending emails, and elaborate on the critical role SMTP plays in ensuring that Raju's email successfully reaches his client's inbox.	10

	Significance of SMTP: SMTP is essential for sending emails, ensuring reliable transmission. **SMTP Mechanics**: 1. Raju composes the email. 2. Her email client connects to her SMTP server. 3. Raju's email is transmitted to the SMTP server. 4. SMTP server validates and relays the email. 5. It reaches the recipient's SMTP server. 6. The email is placed in the client's inbox. **Critical Role of SMTP**: SMTP standardizes email transmission, ensures security, and reliable delivery, making it fundamental for Raju's email to reach her client's inbox.	
18	Priya is setting up a small home network with multiple devices, including computers, smartphones, and a printer. Explain how DHCP can help in simplifying the network configuration process for her devices. **DHCP (Dynamic Host Configuration Protocol)** can simplify the network configuration process for Priya's devices in the following ways: 1. **Automatic IP Assignment**: DHCP automatically assigns IP addresses to devices when they join the network. Priya's devices won't require manual configuration, reducing the risk of IP conflicts. 2. **Efficient Resource Allocation**: DHCP ensures that IP addresses are allocated efficiently. Devices receive IP addresses dynamically and can release them when not in use, preventing address shortages. 3. **Easy Device Integration**: New devices can seamlessly join the network without the need for manual network setup. This simplifies the process of adding new computers, smartphones, or printers. 4. **Centralized Management**: DHCP allows Priya to manage IP configurations from a central DHCP server, making it easy to monitor and control the network's IP address assignments. 5. **Address Leasing**: DHCP can specify the duration (lease time) for which devices can use assigned IP addresses, ensuring optimal network performance and allowing for address reassignment when needed. 6. **Simplified Troubleshooting**: With DHCP, issues related to IP address assignment are reduced, simplifying troubleshooting and maintenance tasks. In summary, DHCP automates the IP configuration process, making it easier for Priya to manage her small home network by reducing manual setup and ensuring efficient use of network resources.	10