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Internal Assessment Test 1 – March 2023

Sub:	Computer Networks				Sub Code:	21CS52	Branch:	AIML		
Date:	13/03/24	Duration:	90 minutes	Max Marks:	50	Sem/Sec:	V	OBE		
<u>Answer any FIVE FULL Questions</u>								MARKS	CO	RBT
1	a	Explain the format of TCP segment structure and mention all its fields in detail.				[10]	4	L2		
2	a	Explain the three-way handshaking for establishing a TCP connection.				[10]	4	L2		
3	a	Explain the services offered by DNS along with DNS record and message format.				[10]	5	L2		
4	a	How would you can compare: i) TCP & UDP ii) HTTP & FTP				[10]	4	L2		
5	a	What approach would we follow if we need a communication service to transmit real time voice over the internet? What feature of TCP & what features of UDP are appropriate.				[05]	4	L3		
	b	Compare two approaches, obtain a name from a file in a remote machine and from a DNS server of the local ISP.				[05]	5	L3		
6	a	Is the vacation agent part of the user agent or the message transfer agent? Of course, it is set up using the user agent, but does the user agent actually send the replies? Explain your answer.				[10]	5	L3		

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Internal Assessment Test II –March 2024

Sub:	Computer Networks					Sub Code:	21CS52	Branch:	AIML	
Date:	/03/2024	Duration:	90 mins	Max Marks:	50	Sem / Sec:	A	Time	08.00 – 10.00 AM	OBE

Answer any FIVE FULL Questions

MAR KS	CO	RB T
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1	<p>Explain the format of TCP segment structure and mention all its fields in detail.</p> <p>Every TCP segment consists of a 20 byte fixed format header. Header options may follow the fixed header. With a header so that it can tag up to 65535 data bytes.</p> <p>The TCP header format is shown in the figure below –</p> <div style="text-align: center;"> <p>TCP Segment Header</p> </div> <p>Source Port</p> <p>It is a 16-bit source port number used by the receiver to reply.</p> <p>Destination Port</p> <p>It is a 16-bit destination port number.</p>	[10]	CO 4	L2
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Sequence Number

The sequence number of the first data byte in this segment. During the SYN Control bit is set, and the sequence number is n , and the first data byte is $n + 1$.

Acknowledgement Number

If the ACK control bit is set, this field contains the next number that the receiver expects to receive.

Data Offset

The several 32-bit words in the TCP header shows from where the user data begins.

Reserved (6 bit)

It is reserved for future use.

URG

It indicates an urgent pointer field that data type is urgent or not.

ACK

It indicates that the acknowledgement field in a segment is significant, as discussed early.

PUSH

The PUSH flag is set or reset according to a data type that is sent immediately or not.

RST

It Resets the connection.

SYN

It synchronizes the sequence number.

FIN

This indicates no more data from the sender.

Window

It is used in Acknowledgement segment. It specifies the number of data bytes, beginning with the one indicated in the acknowledgement number field that the receiver is ready to accept.

Checksum

It is used for error detection.

Options

The IP datagram options provide additional punctuality. It can use several optional parameters between a TCP sender and receiver. It depends on the options used. The length

of the field may vary in size, but it can't be larger than 40 bytes due to the header field's size, which is 4 bit.

2 Explain the three-way handshaking for establishing a TCP connection .

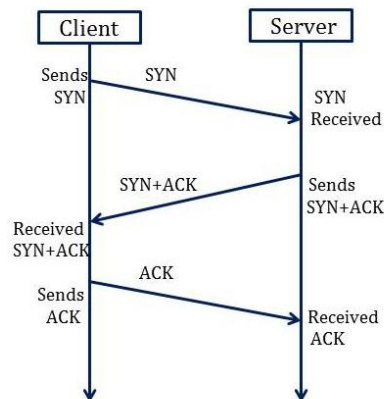
[10]

CO
4 L2

Transmission Control Protocol (TCP) provides a secure and reliable connection between two devices using the 3-way handshake process. TCP uses the full-duplex connection to synchronize (SYN) and acknowledge (ACK) each other on both sides. There are three steps for both establishing and closing a connection. They are – SYN, SYN-ACK, and ACK.

3-Way Handshake Connection Establishment Process

The following diagram shows how a reliable connection is established using 3-way handshake. It will support communication between a web browser on the client and server sides whenever a user



navigates the Internet.

Step 1 (SYN): In the first step, the client wants to establish a connection with a server, so it sends a segment with SYN(Synchronize Sequence Number) which informs the server that the client is likely to start communication and with what sequence number it starts segments with

- **Step 2 (SYN + ACK):** Server responds to the client request with SYN-ACK signal bits set. Acknowledgement(ACK) signifies the response of the segment it received and SYN signifies with what sequence number it is likely to start the segments with

- **Step 3 (ACK):** In the final part client acknowledges the response of the server and they both establish a reliable connection with which they will start the actual data transfer

3 Explain the services offered by DNS along with DNS record and message format.

[10]

CO
5 L2

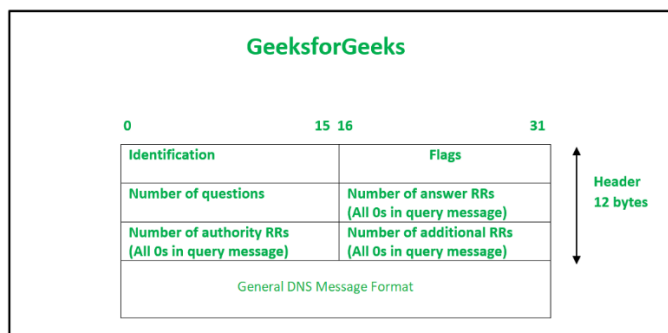
DNS allows you to interact with devices on the Internet without having to remember long strings of numbers. Changing of information between client and server is carried out by two types of DNS messages:

- Query message
- Response message.

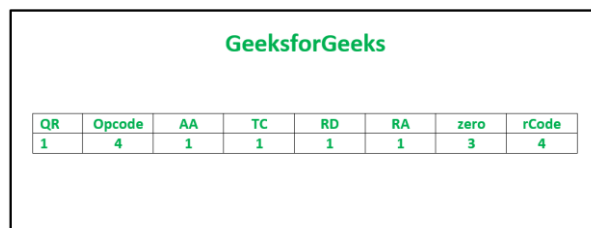
The format is similar for both types of messages. The information is held up in up to five different sections of DNS message format. The query message is having two sections- header and question records.

The response message consists of five sections:

- Header
- Question
- Records
- Answer records
- Authoritative records
- Additional records



- **Identification:** The identification field is made up of 16 bits which are used to match the response with the request sent from the client-side. The matching is carried out by this field as the server copies the 16-bit value of identification in the response message so the client device can match the queries with the corresponding response received from the server-side.
- **Flags:** It is 16 bits and is divided into the following Fields :



Here is the description of each subfield of the Flags field:

- **QR (query/response):** It is a 1-bit subfield. If its value is 0, the message is of request type and if its value is 1, the message is of response type.
- **opcode:** It is a 4-bit subfield that defines the type of query carried by a message. This field value is repeated in the response. Following is the list of opcode values with a brief description:

	<ul style="list-style-type: none"> • If the value of the opcode subfield is 0 then it is a standard query. • The value 1 corresponds to an inverse of query that implies finding the domain name from the IP Address. • The value 2 refers to the server status request. The value 3 specifies the status reserved and therefore not used. • AA: It is an Authoritative Answer. It is a 1-bit subfield that specifies the server is authoritative if the value is 1 otherwise it is non-authoritative for a 0 value. • TC: It is Truncation. This is a 1-bit subfield that specifies if the length of the message exceeds the allowed length of 512 bytes, the message is truncated when using UDP services. • RD: It is Recursion Desired. It is a 1-bit subfield that specifies if the value is set to 1 in the query message then the server needs to answer the query recursively. Its value is copied to the response message. • RA: It is Recursion Available. It is a 1-bit subfield that specifies the availability of recursive response if the value is set to 1 in the response message. • Zero: It is a 3-bit reserved subfield set to 0. • rCode: It stands for Response Code. It is a 4-bit subfield used to denote whether the query was answered successfully or not. If not answered successfully then the status of error is provided in the response. Following is the list of values with their error status – <ul style="list-style-type: none"> • The value 0 of rcode indicates no error. • A value of 1 indicates that there is a problem with the format specification. • Value 2 indicates server failure. • Value 3 refers to the Name Error that implies the name given by the query does not exist in the domain. • Value of 4 indicates that the request type is not supported by the server. • The value 5 refers to the nonexecution of queries by the server due to policy reasons. 			
4 (a)	<p>How would you can compare: i) TCP & UDP ii) HTTP & FTP</p> <p>Differences between TCP and UDP The main differences between TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) are:</p>	[10]	CO4	L2

	Basis	Transmission Control Protocol (TCP)	User Datagram Protocol (UDP)			
	Type of Service	<p><u>TCP</u> is a connection-oriented protocol. Connection orientation means that the communicating devices should establish a connection before transmitting data and should close the connection after transmitting the data.</p>	<p><u>UDP</u> is the Datagram-oriented protocol. This is because there is no overhead for opening a connection, maintaining a connection, or terminating a connection. UDP is efficient for broadcast and multicast types of network transmission.</p>			
	Reliability	<p>TCP is reliable as it guarantees the delivery of data to the destination router.</p>	<p>The delivery of data to the destination cannot be guaranteed in UDP.</p>			
	Error checking mechanism	<p>TCP provides extensive error-checking mechanisms. It is because it provides flow control and acknowledgment of data.</p>	<p>UDP has only the basic error-checking mechanism using checksums.</p>			
	Acknowledgment	<p>An acknowledgment segment is present.</p>	<p>No acknowledgment segment.</p>			

Sequence	<p>Sequencing of data is a feature of Transmission Control Protocol (TCP). this means that packets arrive in order at the receiver.</p>	<p>There is no sequencing of data in UDP. If the order is required, it has to be managed by the application layer.</p>
Speed	<p>TCP is comparatively slower than UDP.</p>	<p>UDP is faster, simpler, and more efficient than TCP.</p>
Retransmission	<p>Retransmission of lost packets is possible in TCP, but not in UDP.</p>	<p>There is no retransmission of lost packets in the User Datagram Protocol (UDP).</p>
Header Length	<p>TCP has a (20-60) bytes variable length header.</p>	<p>UDP has an 8 bytes fixed-length header.</p>
Weight	<p>TCP is heavy-weight.</p>	<p>UDP is lightweight.</p>
Handshaking Techniques	<p>Uses handshakes such as SYN, ACK, SYN-ACK</p>	<p>It's a connectionless protocol i.e. No handshake</p>
Broadcasting	<p>TCP doesn't support Broadcasting.</p>	<p>UDP supports Broadcasting.</p>
Protocols	<p>TCP is used by HTTP, HTTPs, FTP, SMTP and Telnet.</p>	<p>UDP is used by DNS, DHCP, TFTP, SNMP, RIP, and VoIP.</p>
Stream Type	<p>The TCP connection is a byte stream.</p>	<p>UDP connection is a</p>

			message stream.
Overhead	Low but higher than UDP.		Very low.
Applications	This protocol is primarily utilized in situations when a safe and trustworthy communication procedure is necessary, such as in email, on the web surfing, and in military services.		This protocol is used in situations where quick communication is necessary but where dependability is not a concern, such as VoIP, game streaming, video, and music streaming, etc.

ii) HTTP & FTP

Difference between FTP and HTTP :

S.NO.	HTTP	FTP
1.	It stands for HyperText Transfer Protocol.	It stands for File Transfer Protocol
2.	It is the set of rules that how web pages are transferred on different computers over the internet.	It is the set of rules that permit the downloading and uploading the files on the computer over the internet.
3.	It only supports the data connection.	It supports both data connection and control connection
4.	It uses Transmission Control Protocol and runs on TCP port 80.	It uses Transmission Control Protocol and runs on TCP port 20 and TCP port 21.
5.	The URL using the HTTP protocol will start with HTTP.	The URL using the FTP will start with FTP.

	6.	It does not require authentication.	It requires authentication.			
	7.	It is efficient in transferring small files.	It is efficient in transferring large files.			
	8.	The files transferred to the computer over the internet are not saved to the memory.	The files transferred to the computer over the internet are saved to the memory.			
	9.	HTTP is used to provide the web pages to the web browser from the webserver	FTP is used to upload or download files between client and server.			
	10.	It is a stateless protocol.	It is not a stateless protocol and it maintains states.			
5 (a)	<p>What approach would we follow if we need a communication service to transmit real time voice over the internet? What feature of TCP & what features of UDP are appropriate.</p> <p>For real-time services like computer gaming, voice or video communication, and live conferences; we need UDP. Since high performance is needed, UDP permits packets to be dropped instead of processing delayed packets. There is no error checking in UDP, so it also saves bandwidth.</p> <p>Real-time data transmission applications typically use UDP as the transport protocol.</p> <p>For example, the Real-time Transport (RTP) protocol uses UDP.</p> <p>The service model offered by UDP is more suitable for audio/video transmission than the service model offered by TCP.</p> <p>Let's focus on the characteristics and requirements of the real-time audio/video applications and try to understand why the service model offered by UDP is more suitable.</p> <p>Typically, in real-time applications, your client receives packets from a server. These packets contain fragments of the audio/video that you are watching. Each packet contains a few milliseconds of audio or a few video frames.</p> <p>When a audio fragment or video frame is to be played, the packet containing that fragment/frame must have already arrived at your client. Otherwise, your client will have to pause the audio/video while waiting to receive the required fragment/frame. The problem can be mitigated by using buffering (for example, the approach used by YouTube). But it is important to have a low delay in data transfer for real-time audio/video applications.</p>			[5]	CO4	L3

If your client did not receive a packet every now and then, it would lose only a few milliseconds of audio or a few video frames. This would be acceptable because the human ear/eye has limited sensitivity and therefore you probably wouldn't even notice the missing milliseconds/frames.

The following table shows the similarities and differences between UDP and TCP.

	TCP	UDP
Multiplexing/Demultiplexing	Yes	Yes
Error detection	Yes	Yes
Reliable packet delivery	Yes	No
Ordered packet delivered	Yes	No
Congestion control	Yes	No
Flow control	Yes	No

TCP offers a reliable data transfer. The client needs to send a packet receipt acknowledgment (ACK) for each packet received. The server retransmits a packet until it is sure that the client has received it (i.e., until it receives an ACK for the packet).

As stated previously, for audio/video applications it is okay to lose a packet every now and then. But it is very important to have a low delay. ACK and retransmission mechanism provided by TCP adds unnecessary overhead (for each packet the client needs to send an ACK) and increases delay.

Moreover, TCP provides congestion control and flow control. Congestion control reduces the sending rate of the server when network congestion occurs. Flow control reduces the sending rate of the server when your client cannot process packets at high rates. Both congestion control and flow control increase the delay.

These are the reasons why many real-time audio/video applications use UDP. But this is not mandatory. An application can use TCP as well for real-time data transmission.

5 (b)

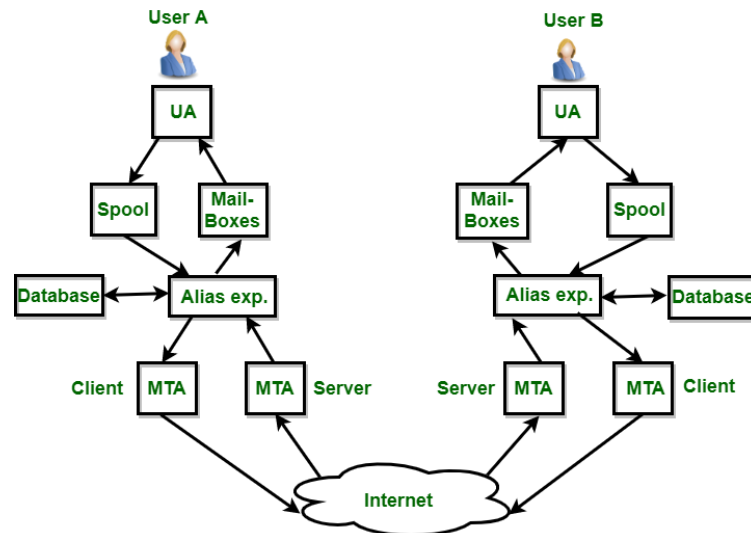
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[5]

CO
5 L3

6	<p>Is the vacation agent part of the user agent or the message transfer agent? Of course, it is set up using the user agent, but does the user agent actually send the replies? Explain your answer.</p> <p>Electronic mail, commonly known as email, is a method of exchanging messages over the internet. Here are the basics of email:</p> <ol style="list-style-type: none"> 1. An email address: This is a unique identifier for each user, typically in the format of name@domain.com. 2. An email client: This is a software program used to send, receive and manage emails, such as Gmail, Outlook, or Apple Mail. 3. An email server: This is a computer system responsible for storing and forwarding emails to their intended recipients. <p>To send an email:</p> <ol style="list-style-type: none"> 1. Compose a new message in your email client. 2. Enter the recipient's email address in the "To" field. 3. Add a subject line to summarize the content of the message. 4. Write the body of the message. 5. Attach any relevant files if needed. 6. Click "Send" to deliver the message to the recipient's email server. 7. Emails can also include features such as cc (carbon copy) and bcc (blind carbon copy) to send copies of the message to multiple recipients, and reply, reply all, and forward options to manage the conversation. <p>Electronic Mail (e-mail) is one of most widely used services of Internet. This service allows an Internet user to send a message in formatted manner (mail) to the other Internet user in any part of world. Message in mail not only contain text, but it also contains images, audio and videos data. The person who is sending mail is called sender and person who receives mail is called recipient. It is just like postal mail service. Components of E-Mail System : The basic components of an email system are : User Agent (UA), Message Transfer Agent (MTA), Mail Box, and Spool file. These are explained as following below.</p> <ol style="list-style-type: none"> 1. User Agent (UA) : The UA is normally a program which is used to send and receive mail. Sometimes, it is called as mail reader. It accepts variety of commands for composing, receiving and replying to messages as well as for manipulation of the mailboxes. 2. Message Transfer Agent (MTA) : MTA is actually responsible for transfer of mail from one system to another. To send a mail, a system must have client MTA and system MTA. It transfer mail to mailboxes of recipients if they are connected in the same machine. It delivers mail to peer MTA if 	[10]	CO 5	L2
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destination mailbox is in another machine. The delivery from one MTA to another MTA is done by [Simple Mail Transfer Protocol](#).



1. **Mailbox** : It is a file on local hard drive to collect mails. Delivered mails are present in this file. The user can read it delete it according to his/her requirement. To use e-mail system each user must have a mailbox . Access to mailbox is only to owner of mailbox.
2. **Spool file** : This file contains mails that are to be sent. User agent appends outgoing mails in this file using SMTP. MTA extracts pending mail from spool file for their delivery. E-mail allows one name, an **alias**, to represent several different e-mail addresses. It is known as **mailing list**, Whenever user have to sent a message, system checks recipient's name against alias database. If mailing list is present for defined alias, separate messages, one for each entry in the list, must be prepared and handed to MTA. If for defined alias, there is no such mailing list is present, name itself becomes naming address and a single message is delivered to mail transfer entity.

Services provided by E-mail system :

- **Composition** – The composition refer to process that creates messages and answers. For composition any kind of text editor can be used.
- **Transfer** – Transfer means sending procedure of mail i.e. from the sender to recipient.
- **Reporting** – Reporting refers to confirmation for delivery of mail. It help user to check whether their mail is delivered, lost or rejected.
- **Displaying** – It refers to present mail in form that is understand by the user.
- **Disposition** – This step concern with recipient that what will recipient do after receiving mail i.e save mail, delete before reading or delete after reading.

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CO PO Mapping

CO-PO and CO-PSO Mapping

CO-PO and CO-PSO Mapping																			
Course Outcomes		Blo oms Lev el	Mo dule s cove red	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	P S O 1	P S O 2	P S O 3	P S O 4
CO1	Analyze and compare various networking protocols.	L1	7,8,9,10,11,12	2	-	-	-	-	-	-	1	1	-	-	2	-	2	-	-
CO2	Demonstrate the working of different concepts of networking	L2	7,8,9,10,11,12	2	3	3	-	-	-	-	1	1	-	-	2	-	2	-	-
CO3	Implement, analyze and evaluate networking protocols in NS2 / NS3 and JAVA programming language	L3	1,2,3,4,5,6	2	2	3	-	-	-	-	1	1	-	-	2	-	2	-	-

COGNITIVE
LEVEL

REVISED BLOOMS TAXONOMY KEYWORDS

L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)				CORRELATION LEVELS	
PO1	Engineering knowledge	PO7	Environment and sustainability	0	No Correlation
PO2	Problem analysis	PO8	Ethics	1	Slight/Low
PO3	Design/development of solutions	PO9	Individual and team work	2	Moderate/ Medium
PO4	Conduct investigations of complex problems	PO10	Communication	3	Substantial/ High
PO5	Modern tool usage	PO11	Project management and finance		
PO6	The Engineer and society	PO12	Life-long learning		
PSO1	Develop applications using different stacks of web and programming technologies				
PSO2	Design and develop secure, parallel, distributed, networked, and digital systems				
PSO3	Apply software engineering methods to design, develop, test and manage software systems.				
PSO4	Develop intelligent applications for business and industry				