AUTUMN MID SEMESTER EXAMINATION-2025

School of Computer Engineering
Kalinga Institute of Industrial Technology, Deemed to be University
Computer Networks
[CS 30003]

Time: 1 1/2 Hours **Full Mark: 20**

Answer Any four questions including question No.1 which is compulsory.
The figures in the margin indicate full marks.
Candidates are required to give theiranswers in their own words as far as practicable and all parts of a question should beanswered at one place only.

1. Answer all the questions. [1 Mark X 5]

a) Consider two hosts, A and B, connected by a single link of rate R bps. Suppose that the two hosts are separated by m meters, and the propagation speed along the link is s meters/sec. Host A is to send a packet of size L bits to Host B. How much time will it take to reach a packet from Host A to Host B?

Solution:
Propagation Delay= m/s, Transmission Delay= L/R,
Total Time= m/s + L/R

b) Why TCP/IP protocol is preferable over UDP/IP protocol for data transfer?

Solution: TCP/IP is preferable over UDP/IP because it provides reliable, connection-oriented communication with error detection, retransmission, and flow control, ensuring accurate data delivery, unlike UDP which is unreliable and connectionless.

c) State different components of data communication.

Solution: Data communication components are sender, receiver, message, transmission medium, and protocol.

d) **Differenciate between TCP window size and maximum segment size?**

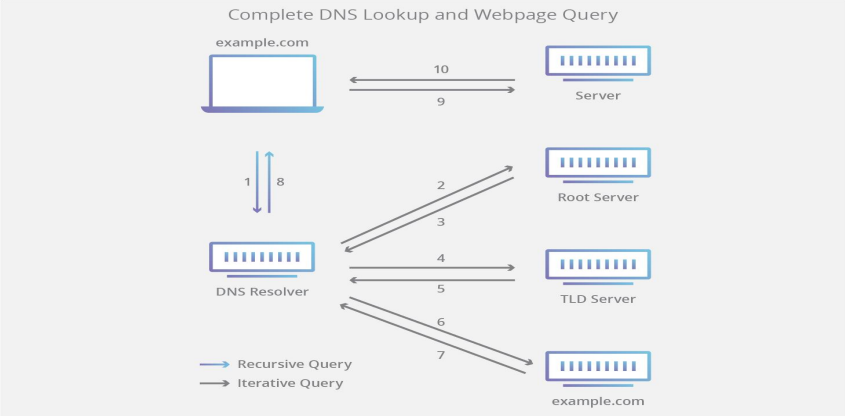
Solution: TCP window size refers to the total amount of unacknowledged data a TCP connection can have in transit, acting as a flow control mechanism to prevent the receiver from being overwhelmed. In contrast, the TCP maximum segment size (MSS) defines the largest chunk of actual data that can fit into a single TCP segment (packet), a value derived from the network's Maximum Transmission Unit (MTU). The MSS is about the maximum payload of one packet, while the window size is about the maximum number of packets (or bytes) that can be sent before an acknowledgment is required.

e) What are FQDN and PQDN?

Solution: Refer to text book, Page No. 489
FQDN (Fully Qualified Domain Name): The complete domain name that specifies its exact location in the DNS hierarchy (e.g., www.example.com.).

PQDN (Partially Qualified Domain Name): An incomplete domain name that does not include all levels of the hierarchy (e.g., www or example).

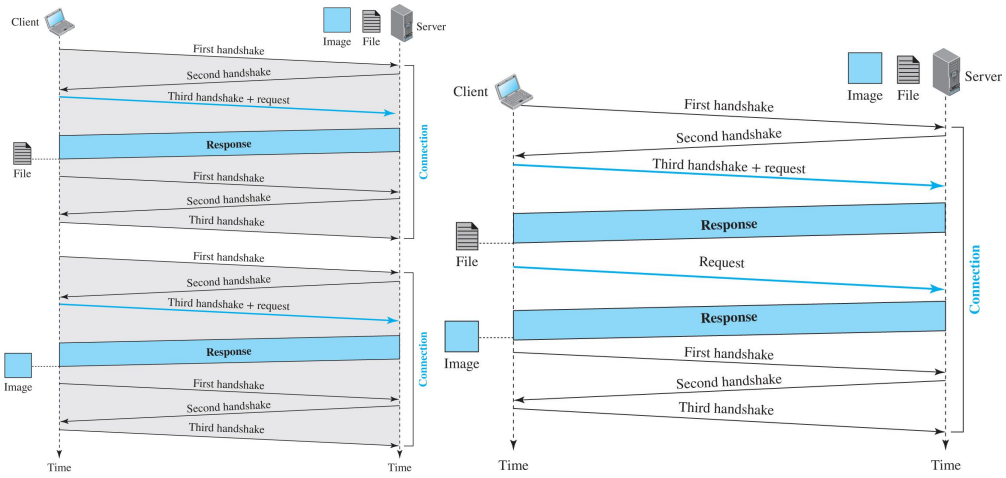
2. (a) When you type a website address (e.g., www.kiit.ac.in) into a browser, the system performs a DNS lookup to resolve the domain name into an IP address before communication begins. Explain the steps involved in the DNS lookup process, starting from the user's machine to the point where the IP address of the domain is obtained.



A user types 'www.kiit.ac.in' into a web browser and the query travels into the Internet and is received by a DNS recursive resolver.The resolver then queries a DNS root nameserver (.).The root server then responds to the resolver with the address of a Top Level Domain (TLD) DNS server (such as .com or .net), which stores the information for its domains. When searching for example.com, our request is pointed toward the .com TLD. The resolver then makes a request to the .com TLD. The TLD server then responds with the IP address of the domain's nameserver, example.com. Lastly, the recursive resolver sends a query to the domain's nameserver. The IP address for example.com is then returned to the resolver from the nameserver. The DNS resolver then responds to the web browser with the IP address of the domain requested initially. Once the 8 steps of the DNS lookup have returned the IP address for example.com, the browser is able to make the request for the web page: The browser makes a HTTP request to the IP address. The server at that IP returns the webpage to be rendered in the browser (step 10).

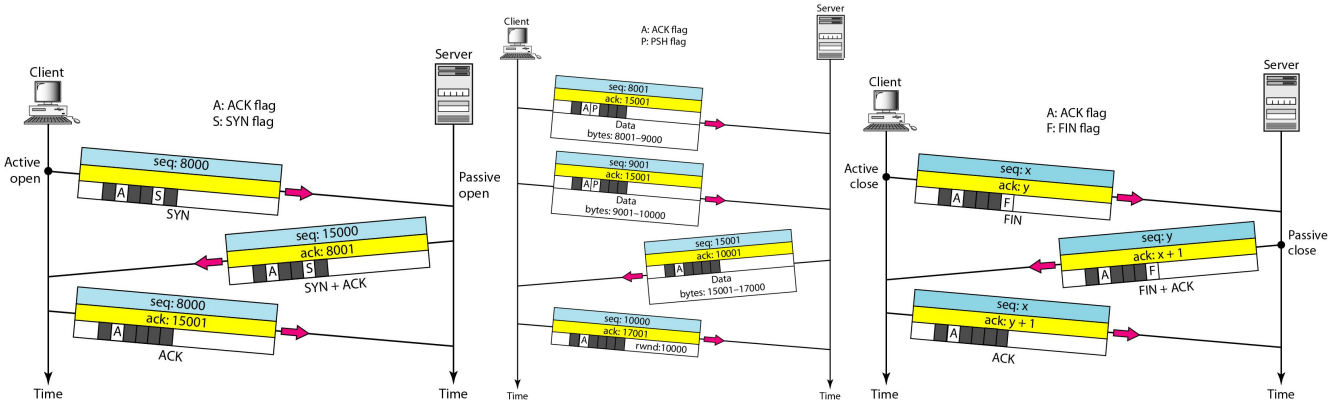
(b) What are Persistent and Non-persistant HTTP connections? Give examples of both using timeline diagram. [2 Marks]

Solution: Refer to Text Book, Section: 10.3, Page No. 453-455

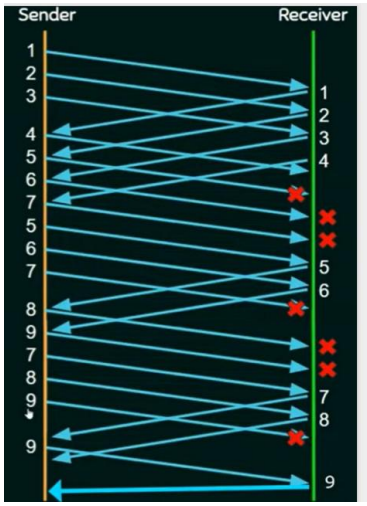


3.(a) Explain the process of TCP connection establishment, data transfer, and connection termination between a client and a server. [3 Marks]

Solution: Refer to Text Book, Section9.4.4, Page No. 371-375



(b) Station A needs to send a message consisting of 9 packets to station B 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 A transmits gets lost (but no ACKs from B ever get lost), then what is the number of packets that A will transmit for sending the message to B. Explain your answer with transition diagram. [2 Marks]



A will transmit total **16** packets to B

4. (a) Assume that, in a Stop-and-Wait ARQ system, the bandwidth of the line is 1 Mbps, and 1 bit takes 20 milliseconds to make a round trip. Calculate the bandwidth-delay product of the channel. If the system data packets are 1,000 bits in length, calculate the utilization percentage of the link for the Stop-and-Wait protocol. If we use a protocol that allows transmission of up to 15 packets before waiting for acknowledgments (similar to Go-Back-N ARQ), calculate the utilization percentage of the link. [3 Marks]

Solution: The bandwidth-delay product is $(1 \times 10^6) \times (20 \times 10^{-3}) = 20{,}000$ bits. The system can send 20,000 bits during the time it takes for the data to go from the sender to the receiver and the acknowledgment to come back. However, the system sends only 1,000 bits. The link utilization is only 1,000/20,000, or 5 percent.

If the system can send up to 15 packets or 15,000 bits during a round trip. This means the utilization is 15,000/20,000, or 75 percent.

(b) The following is a dump of TCP header dump in hexadecimal format

E2930017000000010000000500207FF….

Find souce port number, destination port number, sequence number, acknowledgement number, header length, type of the segment, and window size. [2 Marks]

Solution:

First 4 hexadecimal number (or 16 bits) identifies source port number.

Source Port Number: $(E293)_{16}$ = **58003**

Next 4 hexadecimal number (or 16 bits) identifies destination port number.

Destination Port Number: $(0017)_{16}$ = **23**

Next 8 hexadecimal number (or 32 bits) identifies sequence numbar

Sequence Number: $(00000001)_{16}$ = **1**

Next 8 hexadecimal number (or 32 bits) identifies acknowledgement number

Acknowledgement Number: $(00000000)_{16}$ = **0**

$(5002)_{16} = (0101000000000010)_2$

First 4 bits identifies header length.

Header Length: $(0101)_2$ = 5 bytes = (5x4) bits = **20 bits**

Next 6 bits are reserve bits, i.e., 000000

Flag Bits are 000010

Type of segment: **SYN** as SYN bit is 1 all 6 flags, i.e., 000010

Window Size: $(07FF)_{16}$ = **2047**

5. Write down short notes on following topics (any two). [2.5 Marks x 2]

(i) Network Topology

Refer to Text Book, Section1.2.2, Page No. 6

(ii) Simple Mail Transfer Protocol

Refer to Text Book, Section 10.3.3. Page No. 472

(iii) TCP Congestion Control

Refer to Text Book, Section: 9.4.9, Page No. 398

*** Best of Luck ***