AUTUMN MID SEMESTER EXAMINATION-2023

School of Computer Engineering
Kalinga Institute of Industrial Technology, Deemed to be University
Computer Network
[IT-3009]

Time: 1 1/2 Hours   Full Mark: 40

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

1. Answer all the questions.   [2 x 5]

    a) The following is the contents of a UDP header in hexadecimal format.
       CB840050001F001F
       I) What is the length of the data?
       II) What is the destination port number?

    b) Consider 2 computers x and y connected by a single line of bandwidth 512 mbps. Let propagation speed be 2×10^9 meter per second. The the packet length be 1 kb. Calculate the distance between x and y if propagation delay is same as transmission delay.

    c) Why TCP uses a 32 bit sequence number in TCP header? In TCP how many sequence numbers are consumed by each of the following segments: **ACK, SYN +ACK, FIN**.

    d) Given a TCP header with a header length field value of 0111, calculate the actual length of the TCP header in bytes. How many bits optional data is added with the header in this case?

    e) In a network using the Go-Back-N protocol with m = 3 and the sending window of size 7, the values of variables are $S_f = 62$, $S_n = 66$, and $R_n = 64$. Assume that the network does not duplicate or reorder the packets. What are the sequence numbers of data packets in transit?

2.   [5+5 Marks]

A) A user is suppose to access a Web page. The IP address for the associated URL is not known to the local host, so a DNS lookup is carried out to obtain the IP address. Suppose, n DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of RTT1, . . ., RTTn. Further suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT0 denote the RTT between the local host and the server containing the object. Calculate the time elapses from when the client clicks on the link until the client receives the object?

B) Explain Email protocols in detail (SMTP,MIME and POP3).

3.   [5+5 Marks]

A) Consider a network using the Selective Repeat protocol for reliable data transmission. The sender's window size is 4 and the receiver's window size is also 4. The sequence numbers are 0 to 15. The sender

has sent packets up to sequence number 10, and all acknowledgments up to sequence number 7 have been received by the sender.

I) Illustrate the sender's and receiver's window positions on a sequence number line.

II) If the receiver has received packets up to sequence number 9 correctly but packet with sequence number 8 was lost, explain how the receiver and sender will respond.

B) Why does the Selective repeat protocol use the maximum window size 2^{m-1} and Go-Back-N protocol use 2^m-1? Justify your answer with appropriate examples.

[5+5 Marks]

4.

A) Consider a scenario where Host A is establishing a TCP connection with Host B. Host A initiates the connection by sending a TCP segment with the SYN flag set to 1 and the Sequence Number set to 1000. Host B responds with a TCP segment with both the SYN and ACK flags set to 1, Acknowledgment Number set to 1200, and Sequence Number set to 2000.

I) Explain the significance of the SYN and ACK flags in the initial connection setup.

II) What is the next expected Sequence Number that Host A should use when sending data to Host B?

III) If Host A wants to terminate the connection after exchanging data, in what way would the FIN flag be used?

B) Imagine you are designing a network application that will use TCP for reliable data transmission. Provide a comprehensive explanation of the various components and fields present in a TCP segment. Your explanation should cover the purpose and significance of each components of TCP segment.

[5+5 Marks]

5.

A) Suppose host A is sending a large file to host B over a TCP connection. The two end hosts are 10 ms apart (20 ms RTT) connected by a 1 Gbps link. Assume that they are using a packet size of 1000 bytes to transmit the file. For simplicity ignore ack packets. Atleast how big would the window size (in packets) have to be for the channel utilization to be greater than 80% ?

B) What is the difference between centralized P2P network and decentralized P2P network? In a DHT-based network, assume m = 4. If the hash of a node identifier is 18, where is the location of the node in the DHT space?

*** Best of Luck ***