III Semester 2022-23
Computer Networks
Exercise No 2

Instructions:

1. *All calculations are to be shown for all multiple choice questions/ fill in blanks with numerical values.*
2. *In case of questions with multiple choices without numerical values, all the options are to be discussed for it being correct/ incorrect with proper reasoning and correct statement.*

1. A 3000 km long trunk operates at 1.536 Mbps and is used to transmit 64 byte frames and uses sliding window protocol. If the propagation speed is 6 μsec / km, how many bits should the sequence number field be?
2. Compute approximate optimal window size when packet size is 53 bytes, RTT is 60 msec and bottleneck bandwidth is 155 Mbps.
3. A sliding window protocol is designed for a 1 Mbps point to point link to the moon which has a one way latency (delay) of 1.25 sec. Assuming that each frame carries 1 KB of data, what is the minimum number of bits needed for the sequence number?
4. Host A is sending data to host B over a full duplex link. A and B are using the sliding window protocol for flow control. The send and receive window sizes are 5 packets each. Data packets (sent only from A to B) are all 1000 bytes long and the transmission time for such a packet is 50 μs. Acknowledgement packets (sent only from B to A) are very small and require negligible transmission time. The propagation delay over the link is 200 μs. What is the maximum achievable throughput in this communication?
    a. 7.69×10^6 Bps
    b. 11.11×10^6 Bps
    c. 12.33×10^6 Bps
    d. 15.00×10^6 Bps
5. Station A uses 32 byte packets to transmit messages to station B using a sliding window protocol. The round trip delay between A and B is 80 msec and the bottleneck bandwidth on the path between A and B is 128 Kbps. What is the optimal window size that A should use?
    a. 20
    b. 40
    c. 160
    d. 320
6. A 20 Kbps satellite link has a propagation delay of 400 ms. The transmitter employs the “go back n ARQ” scheme with n set to 10. Assuming that each frame is 100 bytes long, what is the maximum data rate possible?
    a. 5 Kbps
    b. 10 Kbps
    c. 15 Kbps
    d. 20 Kbps
7. Consider the Go back N protocol with a sender’s window size of ‘n’. Suppose that at time ‘t’, the next inorder packet the receiver is expecting has a sequence number of ‘K’. Assume that the medium does not reorder messages.

    Answer the following questions-

A. What are the possible sets of sequence numbers inside the sender's window at time 't'. Assume the sender has already received the ACKs.
    a. [K-1, K+n-1]
    b. [K, K+n-1]
    c. [K, K+n]
    d. [K+n, K-1]

B. If acknowledgements are still on their way to sender, what are all possible values of the ACK field in the messages currently propagating back to the sender at a time 't'?
    a. [K-n, K-1]
    b. [K-1, K-n]
    c. [K, K-n]
    d. [K-n, K+1]

8. 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?

    a. 12
    b. 14
    c. 16
    d. 18

9. In Go back 4, if every 6th packet that is being transmitted is lost and if total number of packets to be sent is 10, then how many transmissions will be required?

10. A 1 Mbps satellite link connects two ground stations. The altitude of the satellite is 36504 km and speed of the signal is 3×10^8 m/sec. What should be the packet size for a channel utilization of 25% for a satellite link using go back 127 sliding window protocol?
    a. 120 bytes
    b. 60 bytes
    c. 240 bytes
    d. 90 bytes

11. Consider a network connecting two systems located 8000 km apart. The bandwidth of the network is 500×10^6 bits per second. The propagation speed of the media is 4×10^6 meters per second. It is needed to design a Go back N sliding window protocol for this network. The average packet size is 10^7 bits. The network is to be used to its full capacity.

    Assume that processing delays at nodes are negligible. Then, the minimum size in bits of the sequence number field has to be _____ ?

12. The maximum window size for data transmission using the selective repeat protocol with n bit frame sequence numbers is-
    a. 2^n
    b. 2^{n-1}
    c. 2^n-1
    d. 2^{n-2}

13. In SR protocol, suppose frames through 0 to 4 have been transmitted. Now, imagine that 0 times out, 5 (a new frame) is transmitted, 1 times out, 2 times out and 6 (another new frame) is transmitted.

    At this point, what will be the outstanding packets in sender's window?

    a. 341526
    b. 3405126
    c. 0123456

d. 654321

14. The selective repeat protocol is similar to Go back N except in the following way-
    a. Frame Formats are similar in both the protocols
    b. The sender has a window defining maximum number of outstanding frames in both the protocols
    c. Both uses piggybacked acknowledgements where possible and does not acknowledge every frame explicitly.
    d. Both uses piggyback approach that acknowledges the most recently received frame

15. Consider a 128 x 10^3 bits/sec satellite communication link with one way propagation delay of 150 msec. Selective Retransmission (repeat) protocol is used on this link to send data with a frame size of 1 KB. Neglect the transmission time of acknowledgement. The minimum number of bits required for the sequence number field to achieve 100% utilization is _____ .