CN 2022 Homework 3

Due date: 2022/12/13 23:59

1. (4%) Is it possible for an application to enjoy reliable data transfer even when the application runs over UDP? If so, how?
2. (6%) Suppose Host A and Host B use a GBN protocol with window size N = 3 and a long-enough range of sequence numbers. Assume Host A sends six application messages to Host B and that all messages are correctly received, except for the first acknowledgment and the fifth data segment. Draw a timing diagram (similar to Figure 3.22), showing the data segments and the acknowledgments sent along with the corresponding sequence and acknowledge numbers, respectively.
3. (24%) Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 126. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 80 and 40 bytes of data, respectively. In the first segment, the sequence number is 127, the source port number is 302, and the destination port number is 80. Host B sends an acknowledgment whenever it receives a segment from Host A.
    a. In the second segment sent from Host A to B, what are the sequence number, source port number, and destination port number?
    b. If the first segment arrives before the second segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number, the source port number, and the destination port number?
    c. If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number?
    d. Suppose the two segments sent by A arrive in order at B. The first acknowledgment is lost and the second acknowledgment arrives after the first timeout interval. Draw a timing diagram, showing these segments and all other segments and acknowledgments sent. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgment that you add, provide the acknowledgment number.
4. (66%) Consider Figure 3.58. Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions.

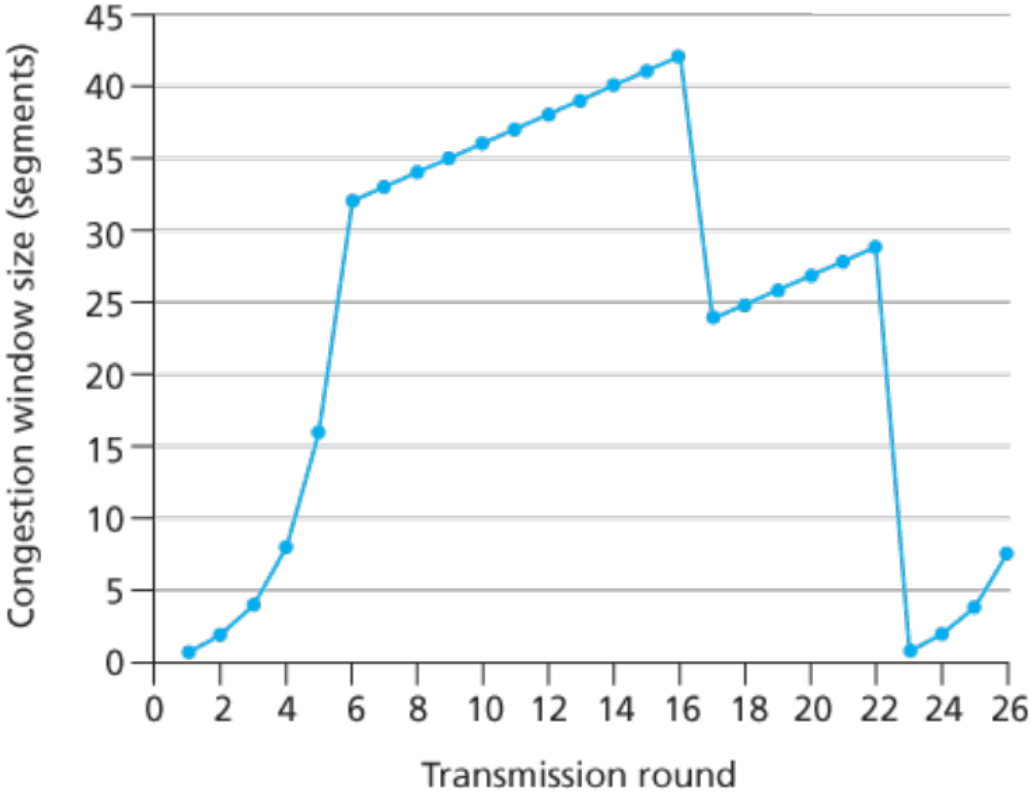

Figure 3.58 TCP window size as a function of time

a. Identify the intervals of time when TCP slow start is operating.
b. Identify the intervals of time when TCP congestion avoidance is operating.
c. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
d. After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
e. What is the initial value of ***ssthresh*** at the first transmission round?
f. What is the value of ***ssthresh*** at the 18th transmission round?
g. What is the value of ***ssthresh*** at the 24th transmission round?
h. During what transmission round is the 70th segment sent?
i. Assuming a packet loss is detected after the 26th round by the receipt of a triple duplicate ACK, what will be the values of the congestion window size and of ***ssthresh*** ?
j. Suppose TCP Tahoe is used (instead of TCP Reno), and assume that triple duplicate ACKs are received at the 16th round. What are the ***ssthresh*** and the congestion window size at the 19th round?
k. Again suppose TCP Tahoe is used, and there is a timeout event at 22nd round. How many packets have been sent out from 17th round till 22nd round, inclusive?