CS3873 Name:_____

Exam 2 : 100 points Your score will be posted on Blackboard

Instructions

Submit your answers clearly written and with each answer clearly numbered. All work must be submitted on Blackboard by the due date and time. Evidence of collaboration with anyone will result in a score of zero and a referral for academic dishonesty. Email if you do not understand a question.

You may need this information: IP header with no options = 20 bytes, UDP header = 8 bytes, TCP header with no options = 20 bytes.

1. What if the designers of UDP and TCP had made a single port number field of 32 bits instead of two fields of 16 bits. This value represents both the *source and destination port*. What is the most obvious flaw with this scheme, given the client-server paradigm? Hint: would it be possible for two different apps on the same client to interact with the same server at the same time?(5 points)

2. In the original TCP, the sender adjusts the congestion window using AIMD. Define this acronym and describe how the window increases, decreases, and the events that cause these increases and decreases (15 points).

3. State whether the following assertions about TCP are true or false (20 points).

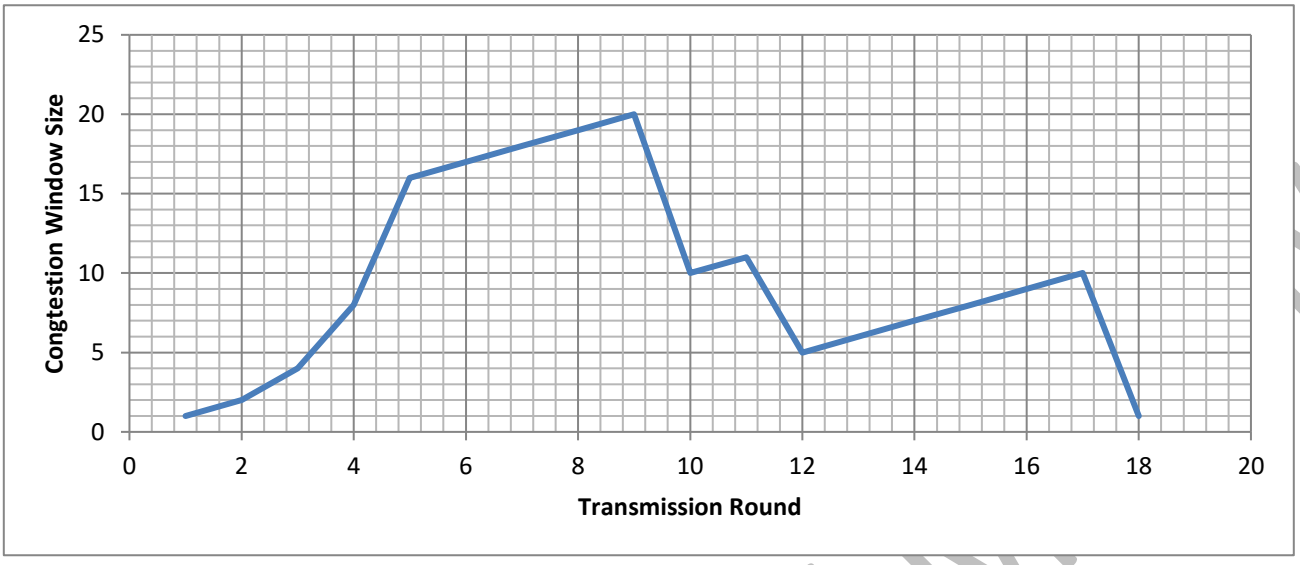
    a. The Receive Window is used to reserve bandwidth for the sender.
    b. The receiver uses a duplicate ACK to indicate a gap in the received segments.
    c. The retransmission timeout is a function of the measured RTT.
    d. The TCP segment header is exactly the same as the UDP segment header, except the TCP flag bit is set.
    e. The only way an application can have reliable data transfer is to use TCP.
    f. TCP loss recovery is always due to congestion.
    g. TCP Reno will give poor performance between a spacecraft on Mars and a server on Earth.
    h. TCP computes where the congestion is occurring (application end points or in the network).
    i. The three-way handshake must be completely finished before any data can be sent.
    j. Kurose gives a formula for estimating TCP throughput that involves the factor $\sqrt{L}$. TCP loss recovery makes L smaller.

4. Consider Steven's TCP state diagram (fig 13-8) at the end of this exam and answer these questions: (10 points)
    a. Does a server typically do a passive or active open?
    b. A classic denial of service attack sends a SYN and then ignores the returned SYN+ACK. Which state needs a timeout to alleviate this situation?
    c. Can a server be in the ESTABLISHED state while the client is in the FIN_WAIT_1 state? If so, suggest a cause.
    d. A server spends most of its time in which two states?
    e. Does a simultaneous open involve the LISTEN state?

5. (20 points) This problem involves computing the total time a TCP connection remains established from the client side view. The parameters you need to compute this are:
    a. Bandwidth between PC A and PC B is 2.048Mb/s.
    b. This TCP implementation is pure AIMD and there are no TCP options, so the TCP header has the minimum size. Assume the layer-2 frame header is zero for your calculations.
    c. Assume that queuing and processing delay are zero.
    d. The one-way latency from A to B is 100ms. It is the same in the reverse direction.
    e. There is no other traffic on the network between A and B.
    f. The MSS is 2048 bytes.
    g. PC A sends 3 full segments to B and PC B responds with 1 full segment after receiving all of the segments from PC A.
    h. Once PC A receives the full segment from PC B, it closes the connection.
    i. Each PC has a large socket buffer that will hold at least 16 full segments.

    Be sure to state any further assumptions you make when computing the connection duration. It helps if you make a diagram like the waterfall charts in the textbook.

6. Consider the following plot of TCP Reno congestion window sizes (expressed in segments) as a function of transmission rounds (10 points).



A. Indicate the slow start, congestion avoidance, and multiplicative decrease regions in the above diagram.	
B. When is segment 32 sent?	
C. Is fast retransmit used? If it is used, indicate the instances where it helped. If it is not used, indicate the regions where fast retransmit can help.	
D. Is fast recovery used? If it is used, indicate the instances where fast recovery is applied. If it is not used, indicate the instances where fast recovery can be applied.	
E. Indicate the initial value of the TCW (threshold) and any changes to its value for the duration indicated	

7. You have just gone to work at XYZ Corporation and you have written an application that mirrors a very large database at your location to a server in another country. Your application uses TCP to transfer the data. The database administrator complained to your boss that, by his calculation, it should only take 20 minutes to move the data over the leased line of XXGb/s between the two locations. This person tells your boss your application is poorly implemented. You know the problem is not your application. How do you explain to your boss that TCP is the reason the transfer takes as long as it does and why this is normal for TCP? Be sure to mention specific factors that affect TCP behavior.(20 points)

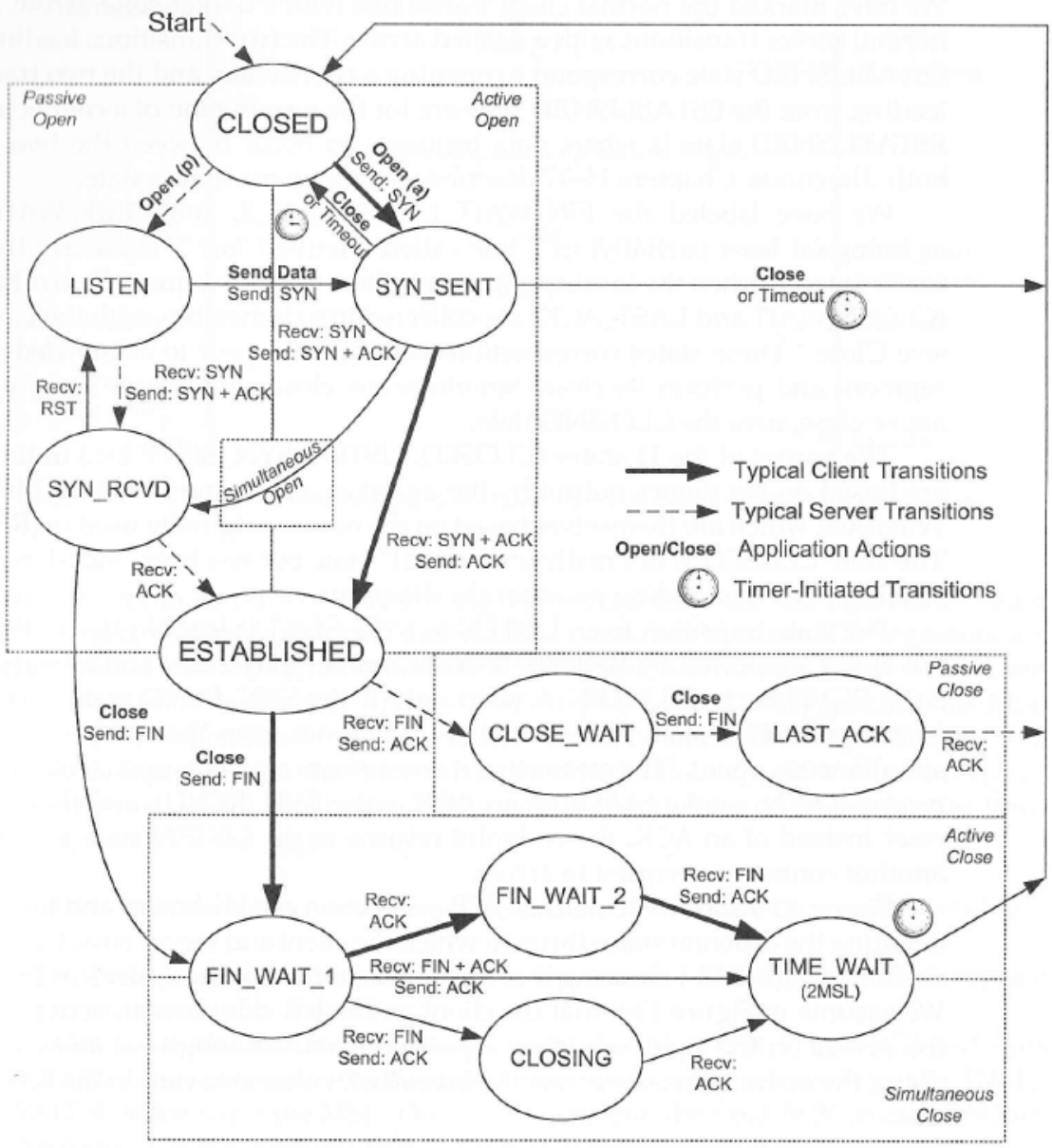


Figure 13-8 The TCP state transition diagram (also called finite state machine). Arrows represent transitions between states due to segment transmission, segment reception, or timers expiring. The bold arrows indicate typical client behavior, and the dashed arrows indicate typical server behavior. The boldface directives (e.g., open, close) are actions performed by applications.