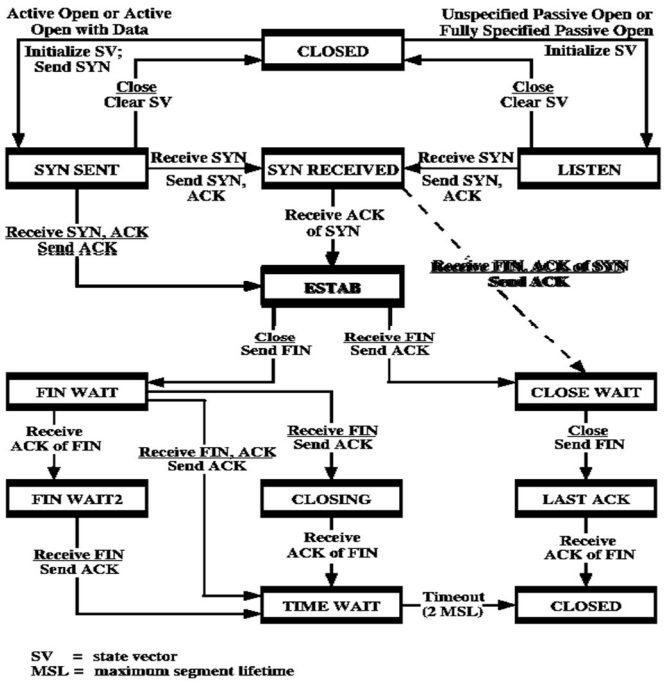
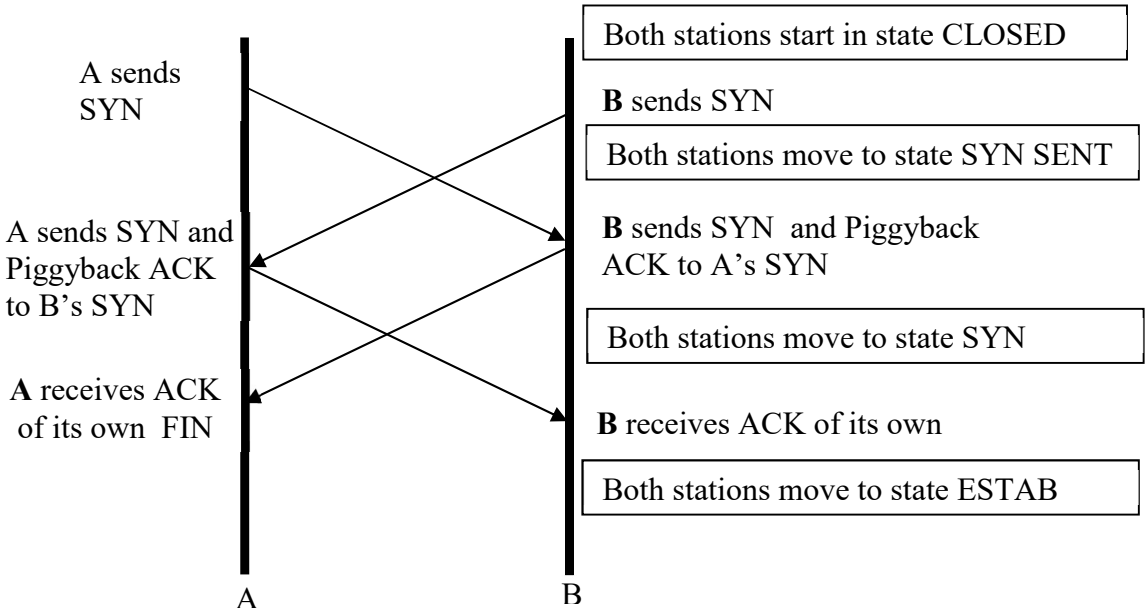
Assignment 3: CMPT 371 SOLUTION

1) [24 points] Refer to the TCP state machine in the class notes (given below). Assume that a TCP connection between stations A(client) and B(server) has been in use. This connection was established using an active-passive open. Explain how the connection can be closed using an active close initiated by the client. To help you explain draw the series of segments exchanged during the active close for each of the three possible paths through the state machine (from stat ESTAB to state CLOSED).



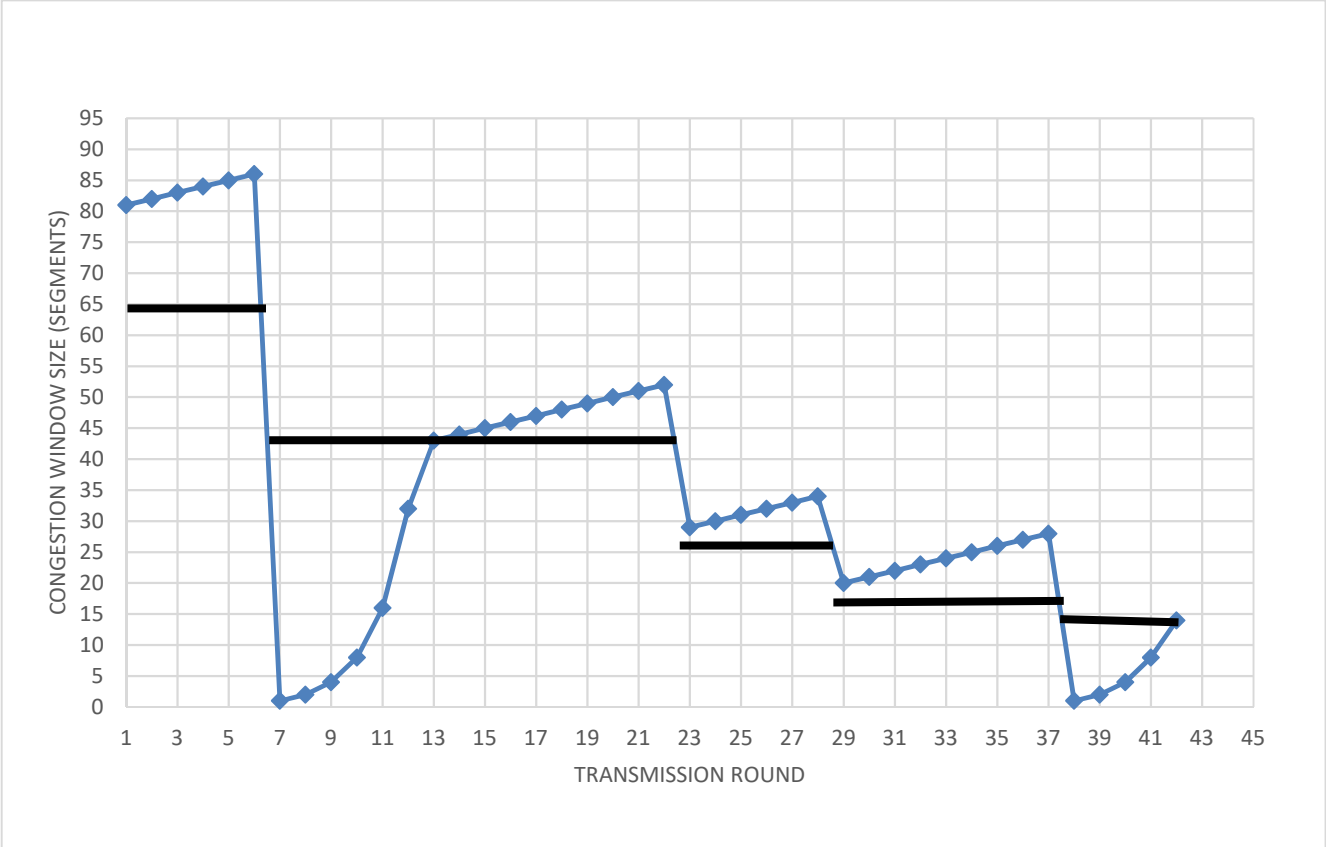
To indicate the type of diagram desired a SAMPLE DIAGRAM of the desired type is shown below the state machine. If you happen to be interested the sample diagram is for and active-active (peer-peer) open

SAMPLE DIAGRAM



2) Consider the figure shown below. Assuming TCP (Reno) is using congestion control (slow start and congestion avoidance modes as discussed in your text and in class) answer the following questions. Assume the system was running before the sample window length data shown in the plot below was collected. Assume the first value of ssthresh shown on the diagram is 64.
Point 1 is asumed to be at the beginning of interval 1. If a failure that causes transition between modes occurs between two points the first point is considered to be part of the pre-failure mode, the second point to be part of the post failure mode. For other transitions between modes (slow start, congestion avoidance) one point is a part of both modes. It is both the end of one mode and the beginning of the other. For example point 13 below would be part of both modes.

For each question you should provide a short discussion justifying your answer.



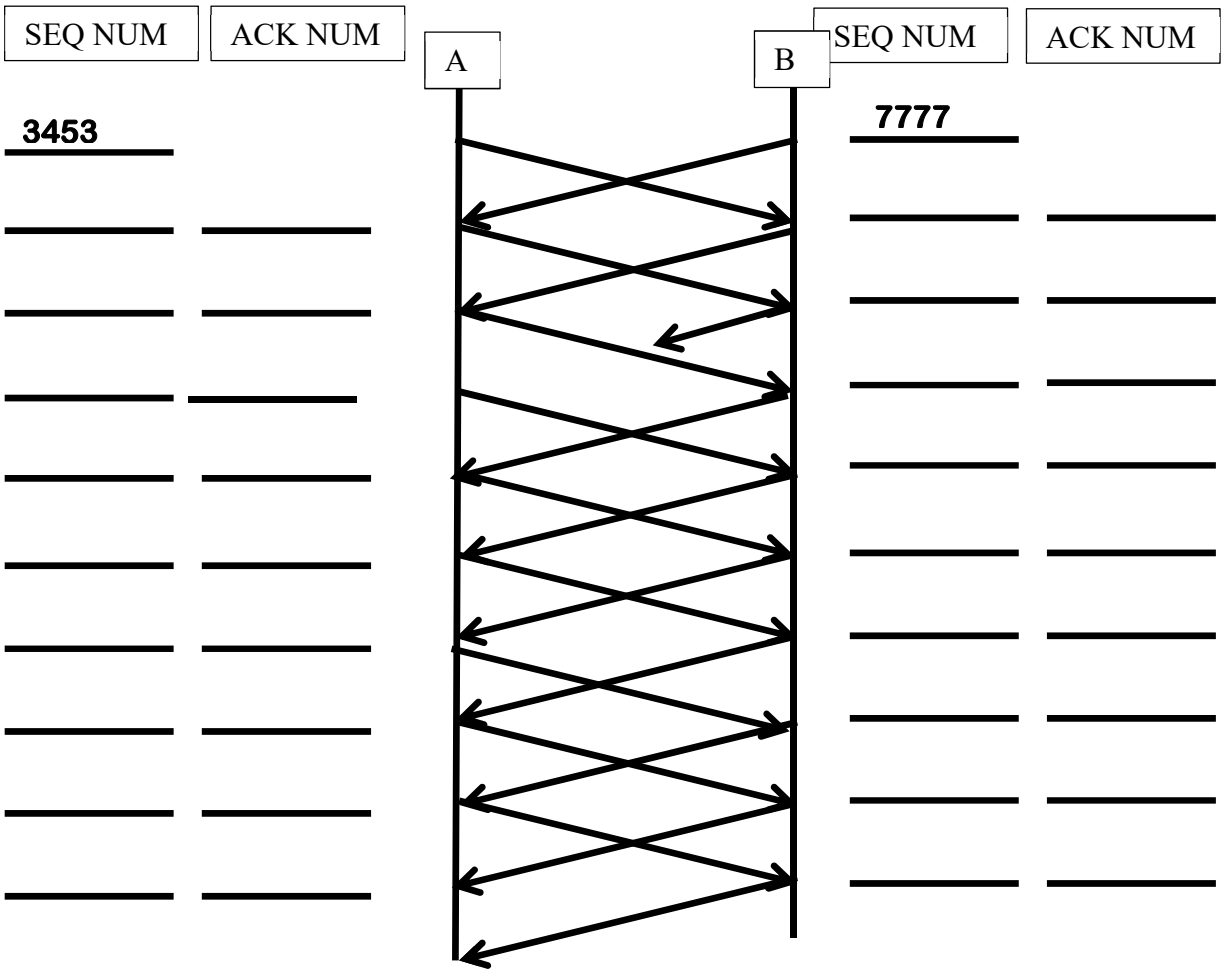
a) **[4 points]** Identify the periods of time when TCP collision avoidance is operating
b) **[4 points]** Identify the periods of time when TCP slow start is operating
c) **[3 points]** During the 6th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? What is the value of ssthresh
d) **[3 points]** During the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
e) **[10 points]** What is the value of ssthresh and the size of the congestion window during the 4th transmission round? During the 16th transmission round? During the 27th round? During the 35th round? During the 39nd round? NOTE: The value of the size of the congestion window during the 4th transmission round is the value at the beginning of the 4th transmission round.

Explain how the values of ssthresh and the congestion window size are determined at each change in the value of ssthresh. The first value of ssthresh (at point 1) is given and need not be discussed.

round	Ssthresh	Congestion window size
4		
16		
27		
35		
39		

f) [2 points] During what transmission round is the 270th segment sent? The 1300th segment? Include the segments sent in transmission round 1.

3) Consider two hosts transferring data using a TCP connection. Assume the connection between hosts A and B has already been made. The establishment of the TCP connection is not a part of this problem. Host A is sending a stream of application data to host B. The first octet of data A is sending to B in the transfer of data illustrated below is octet 3453. Each packet sent by A contains 550 octets of data. Host B is sending a different stream of application data to host A. The first octet of data B is sending to A in the transfer of data illustrated below is 7777. Each packet B is sending to A contains 400 octets of data.
   a) [15 points] Fill in the sequence numbers and acknowledgement number on the diagram below.
   b) [5 points] What are the two TCP error control control mechanisms shown below? These are the mechanisms that help recover from loss of packets or ACKs.
   c) [10 points] Give a step by step description of how the first mechanism you identified in b) operates using the diagram as an example to help in your explanation.
   d) [10 points] Give a step by step description of how the second mechanism you identified in b) operates using the diagram as an example to help in your explanation.


SEQ NUM
ACK NUM
A
B
SEQ NUM
ACK NUM
3453
7777

4) Consider the CIDR routing table shown below.

Destination	*Gateway*	*Mask*	*Interface*	
192.168.48.0	*****	***255.255.240.0***	***eth1***	***Line 1***
192.168.4.0	*****	***255.255.254.0***	***eth2***	***Line 2***
192.168.0.0	*****	***255.248.0.0***	***eth3***	***Line 3***
120.124.160.0	***192.168.0.2***	***255.255.224.0***	***eth3***	***Line 4***
192.156.32.0	***128.168.48.1***	***255.255.255.0***	***eth1***	***Line 5***
0.0.0.0	***192.168.200.12***	***0.0.0.0***	***eth4***	***Line 6***

a) **[5 points]** Is the forwarding table (routing table) above optimized so that the first match found is the "best" match? Explain why or why not

b) **[15 points]** For each address in the table below which line in the routing table on the previous page is used, which interface is the packet sent through, and what the IP address of the host the packet will be sent to in the Ethernet layer? Fill in the table below

Destination address	*Line in forwarding table*	*Interface*	*Next hop IP address*
192.168.5.55			
192.168.6.3			
192.168.55.12			
192.156.33.1			
120.124.160.12			