CCSI 3171 Assignment #4

Due date: July 28th, 11:59pm.
Late submissions are **NOT accepted**!!!!!!

Hand in: Fill out the assignment cover sheet and attach to your assignment. Submit a hardcopy of your assignment in the 3171 assignment box (*the cabinet near the ladies washroom on the second floor*). Any programming must **also** be submitted using the *submit* software that is described on the webpage.

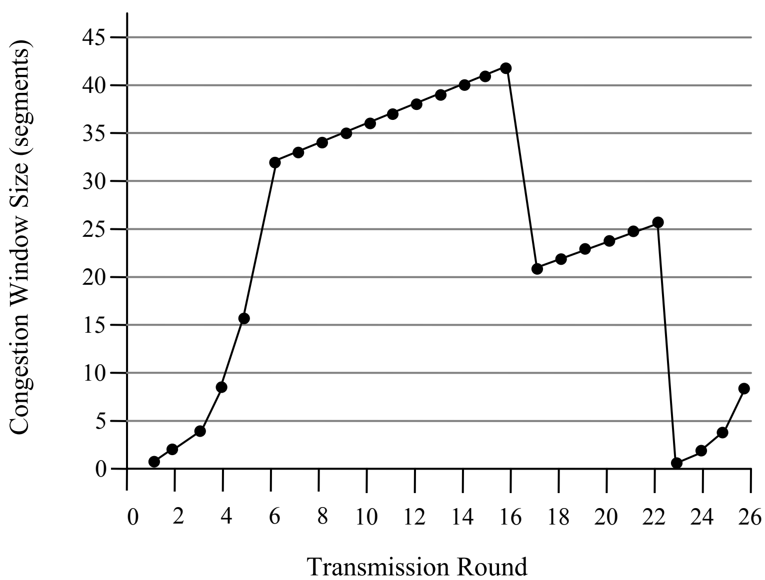
Notes: Show your calculations for all questions.

Read the programming style guidelines on the course webpage.

Read the Dalhousie Policy on Plagiarism.

Assignment Weight in Course = 7%

(i) [20 marks]: Consider the following plot of TCP window size as a function of time.

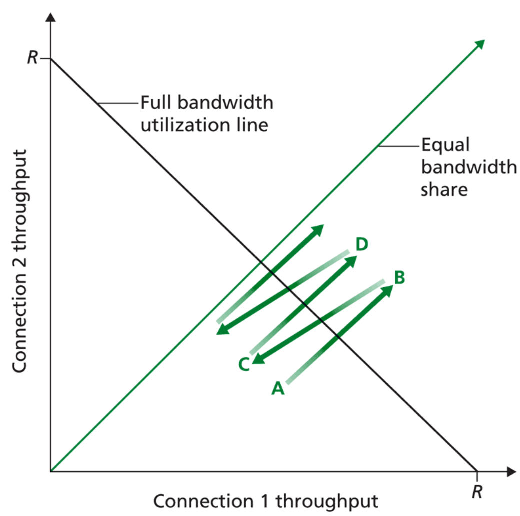


Answer the following questions. In all cases provide a short justification of your answer.

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 'threshold' at the 1st transmission round?
f. What is the value of 'threshold' at the 18th transmission round?
g. What is the value of 'threshold' 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 'threshold'?

(ii) [20 marks]: Consider the following figure which illustrates the convergence of TCP's AIMD algorithm:



Suppose that instead of a multiplicative decrease, TCP decreased the window size by a constant amount. Consider the case where both connections get the same constant decrease and the case where one connection gets a bigger constant decrease than the other. Would the resulting AIAD converge to an equal share algorithm? Justify your answer using two diagrams (for two cases) similar to the figure above.

(iii) [20 marks]: In our discussion of TCP congestion control, we assumed that the TCP sender always had data to send. Consider now the case that the TCP sender sends a large amount of data and then goes idle (since it has no data to send) at time t_1. TCP remains idle for a relatively long period of time and then wants to send more data at time t_2. What are the advantages and disadvantages of having TCP use the `CongWin` and `Threshold` values from time t_1, when starting to send data at time t_2? What alternatives can you imagine for this situation?

(iv) [20 marks]: Consider sending an object of size O = 100 Kbytes from server to client. Let S = 536 bytes and RTT = 100 msec. Suppose the transport protocol uses static windows with window size W.

a. For a transmission rate of 28 kilobits per second, determine the minimum possible latency. Determine the minimum window size that achieves this latency.
b. Repeat (a) for 100 kbps.
c. Repeat (a) for 1 Mbps.
d. Repear (a) for 10 Mbps.

(v) [20 marks]: Answer the following True or False. Explain your answers.

a. If a webpage consists of exactly one object, then non-persistent and persistent connections have exactly the same response-time performance.
b. Consider sending one object of size O from server to browser over TCP. If O > S, where S is the maximum segment size, then the server will stall at least once.
c. Suppose a Web page consists of 10 objects, each of size O bits. For persistent HTTP, the RTT portion of the response time is 20 RTT.
d. Suppose a Web page consists of 10 objects, each of size O bits. For non-persistent HTTP with 5 parallel connections, the RTT portion of the response time is 12 RTT.