(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.

1a) The sequence number is 247. The source port is 52 and the destination port is 80.

1b) The ACK is 248. The source port is 80 and the destination port is 52.

1c) The ACK is 148.

1d)to do

2.

SampleRTT can fluctuate quite a bit segment to segment depending on the congestion at the routers or the traffic at the end systems. Therefore, any fluctuation may be atypical and indicative of the actual average RTT. If we were to use the SampleRTT with an unusually long RTT, then we are reacting too slow to the request.

3.

EstimatedRTT = (1-a)\*EstimatedRTT+a\*SampleRTT

DevRTT=(1−β)⋅DevRTT+β⋅|SampleRTT−EstimatedRTT|

TimeoutInterval=EstimatedRTT+4⋅DevRTT

EstimatedRTT\_1 = .875\*80+.125\*106 = 83.25 ms

DevRTT\_1 = .75\*5 + .25 (106-83.25) = 8.44 ms

TimeoutInterval\_1 = 83.25+4\*8.44 = 117.02 ms

EstimatedRTT\_2 = .875\*83.25 + .125\*120 = 87.84 ms

DevRTT\_2 = .75\*8.44+ .25(120-87.84) = 14.37 ms

TimeoutInterval\_2 = 145.32 ms

EstimatedRTT\_3 = .875\*87.84 + .125\*90 = 88.11 ms

DevRTT\_2 = .75\*14.37 + .25(90-88.11) = 11.25 ms

TimeoutInterval\_3 = 88.11 + 4\*11.25 = 133.11

4. Consider the following plot of TCP window size as a function of time. Assuming TCP Reno is the protocol experiencing the behavior shown in the figure, answer the following questions. In all cases, you should provide a short discussion justifying 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 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) 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?

4a) Slow start on the intervals (2,5) and (23,26).

4b)