Shanti Upadhyay

Comp 4320 Homework 3

1. Because a duplicate ACK is made apparent to the receiver, it is ignored. Once the first / original ACK is received, the process moves forward.

2. For SampleRTT = 85 ms:

   EstimatedRTT $\Rightarrow (1 - 0.2)(110) + 0.2(85) = 105$ ms

   DevRTT $\Rightarrow (1 - 0.25)(10) + 0.25(|85 - 110|) = 13.75$ ms

   TimeoutInterval $\Rightarrow 105 + 4(13.75) = 160$ ms

   For SampleRTT = 130 ms:

   EstimatedRTT $\Rightarrow (1 - 0.2)(105) + 0.2(130) = 110$ ms

   DevRTT $\Rightarrow (1 - 0.25)(13.75) + 0.25(|130 - 105|) = 16.563$ ms

   TimeoutInterval $\Rightarrow 110 + 4(16.563) = 176.3$ ms

   For SampleRTT = 108 ms:

   EstimatedRTT $\Rightarrow (1 - 0.2)(110) + 0.2(108) = 109.6$ ms

   DevRTT $\Rightarrow (1 - 0.25)(16.563) + 0.25(|108 - 110|) = 12.92$ ms

   TimeoutInterval $\Rightarrow 109.6 + 4(12.92) = 161.3$ ms

   For SampleRTT = 72 ms.

   EstimatedRTT $\Rightarrow (1 - 0.2)(109.6) + 0.2(72) = 102.08$ ms

   DevRTT $\Rightarrow (1 - 0.25)(12.92) + 0.25(|72 - 109.6|) = 19.09$ ms

   TimeoutInterval $\Rightarrow 102.08 + 4(19.09) = 178.45$ ms

   For SampleRTT = 142 ms:

   Estimated RTT $\Rightarrow (1 - 0.2)(102.08) + 0.2(142) = 110.064$ ms

   DevRTT $\Rightarrow (1 - 0.25)(19.09) + 0.25(|142 - 102.08|) = 24.29$ ms

   TimeoutInterval $\Rightarrow 110.064 + 4(24.29) = 207.26$ ms

   For SampleRTT = 64 ms:

   EstimatedRTT $\Rightarrow (1 - 0.2)(110.064) + 0.2(64) = 100.85$ ms

   DevRTT $\Rightarrow (1 - 0.25)(24.29) + 0.25(|64 - 110.064|) = 29.739$ ms

   TimeoutInterval $\Rightarrow 100.85 + 4(29.739) = 219.89$ ms

   For SampleRTT = 153 ms:

   EstimatedRTT $\Rightarrow (1 - 0.2)(100.85) + 0.2(153) = 111.281$ ms

   DevRTT $\Rightarrow (1 - 0.25)(29.739) + 0.25(|153 - 100.85|) = 35.34$ ms

   TimeoutInterval $\Rightarrow 111.281 + 4(35.34) = 252.65$ ms

3. a) sequence number : 257

source port number : 3120

destination port number: 5470

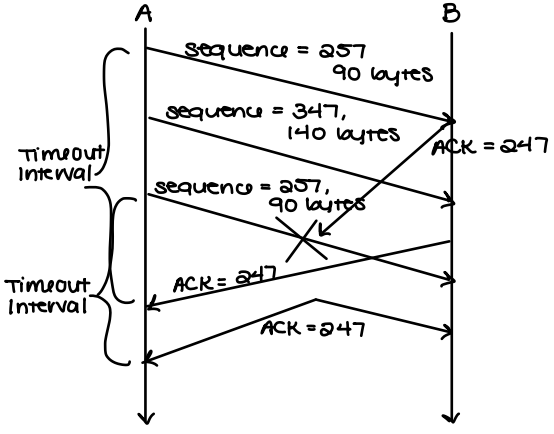
b) acknowledgement number : 257

c) acknowledgement number : 257

source port number: 5470

destination port number: 3120

d) Timing Diagram :



4. go-back-n : X must be greater than or equal to window size + 1

selective repeat: X must be greater than or equal to window size

5. —— segment 0 ⟶ congestion window = 1

- then congestion window is doubled, sending segments 1 and 2
- congestion window is doubled again, now is 4, sending segments 3, 4, 5, 6
- there is a timeout for segment 4
- congestion window doubles again, now is 8, sending segments 7, 8, 9, 10, 11, 12
- triple duplicate ACKs are received
- segment 4 was not received, so congestion window becomes 4
- send segments 6, 7, 8, 9 ⟶ congestion window now increases by 1
- congestion window becomes 5, send segments 10, 11, 12, 13, 14, 15

6. a) Protocol: go-back-n

Host A sends 12 segments, sequence numbers = 0-11

Host B sends 11 ACKs

Protocol: Selective repeat

Host A sends 8 segments, sequence numbers = 0-8

Host B sends 7 ACKs

Protocol: TCP

Host A sends 6 segments, sequence numbers = 3 and 8

Host B sends 6 ACKs, 5 ACKs have sequence number of 3

1 ACK has sequence number of 8

b) TCP protocol