HW 4 Chapter 3 – Part 2

AR14. a) false b) false c) true d) false e) true f) false g) false

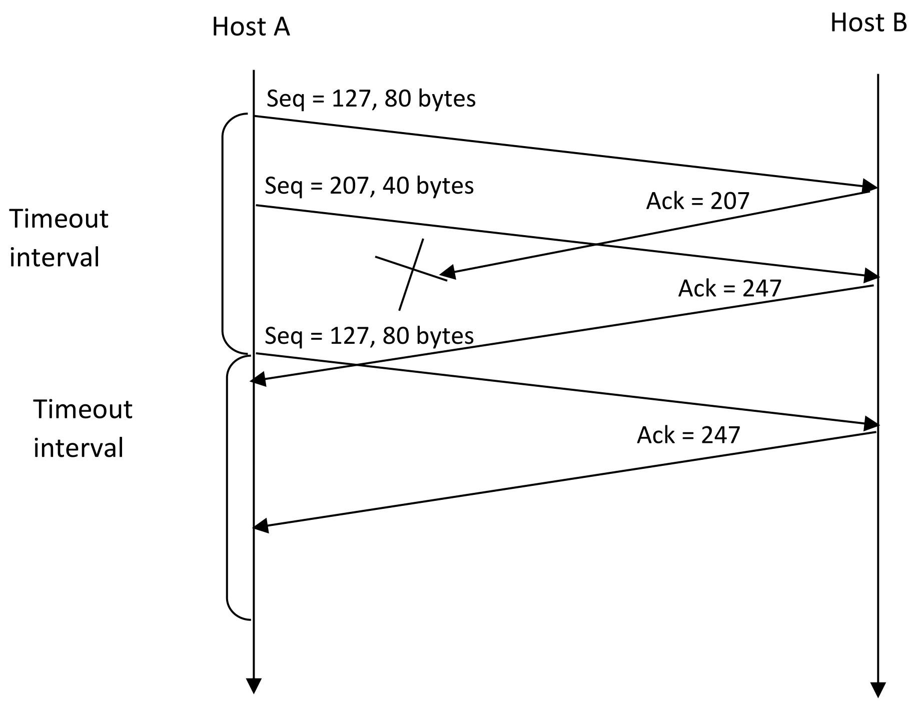
AP27

a) *In the second segment from Host A to B, the sequence number is 207, source port number is 302 and destination port number is 80.*

b) *If the first segment arrives before the second, in the acknowledgement of the first arriving segment, the acknowledgement number is 207, the source port number is 80 and the destination port number is 302.*

c) *(skipped) If the second segment arrives before the first segment, in the acknowledgement of the first arriving segment, the acknowledgement number is 127, indicating that it is still waiting for bytes 127 and onwards.*

d)



AP 31.

*DevRTT = (1- beta) * DevRTT + beta * | SampleRTT - EstimatedRTT |*

*EstimatedRTT = (1-alpha) * EstimatedRTT + alpha * SampleRTT*

*TimeoutInterval = EstimatedRTT + 4 * DevRTT*

After obtaining first SampleRTT 106ms:

*DevRTT = 0.75*5 + 0.25 * | 106 - 100 | = 5.25ms*

*EstimatedRTT = 0.875 * 100 + 0.125 * 106 = 100.75 ms*

*TimeoutInterval = 100.75+4*5.25 = 121.75 ms*

After obtaining 120ms:

*DevRTT = 0.75*5.25 + 0.25 * | 120 – 100.75 | = 8.75 ms*

*EstimatedRTT = 0.875 * 100.75 + 0.125 * 120 = 103.16 ms*

*TimeoutInterval = 103.16+4*8.75 = 138.16 ms*

After obtaining 140ms:

*DevRTT = 0.75*8.75 + 0.25 * | 140 – 103.16 | = 15.77 ms*

*EstimatedRTT = 0.875 * 103.16 + 0.125 * 140 = 107.76 ms*

*TimeoutInterval = 107.76+4*15.77 = 170.84 ms*

After obtaining 90ms:

*DevRTT = 0.75*15.77 + 0.25 * | 90 – 107.76 | = 16.27 ms*

*EstimatedRTT = 0.875 * 107.76 + 0.125 * 90 = 105.54 ms*

*TimeoutInterval = 105.54+4*16.27 =170.62 ms*

After obtaining 115ms:

*DevRTT = 0.75*16.27 + 0.25 * | 115 – 105.54 | = 14.57 ms*

*EstimatedRTT = 0.875 * 105.54 + 0.125 * 115 = 106.72 ms*

*TimeoutInterval = 106.72+4*14.57 =165 ms*

AP37.

a) GoBackN:

A sends 9 segments in total. They are initially sent segments 1, 2, 3, 4, 5 and later re-sent segments 2, 3, 4, and 5.
B sends 8 ACKs. They are 4 ACKS with sequence number 1, and 4 ACKS with sequence numbers 2, 3, 4, and 5.

Selective Repeat:
A sends 6 segments in total. They are initially sent segments 1, 2, 3, 4, 5 and later re-sent segments 2.
B sends 5 ACKs. They are 4 ACKS with sequence number 1, 3, 4, 5. And there is one ACK with sequence number 2.

TCP:

A sends 6 segments in total. They are initially sent segments 1, 2, 3, 4, 5 and later re-sent segments 2.
B sends 5 ACKs. They are 4 ACKS with sequence number 2. There is one ACK with sequence numbers 6. Note that TCP always send an ACK with expected sequence number.

b) *TCP. This is because TCP uses fast retransmit without waiting until time out.*

AP40 (also demonstrated by Ross).

a) *TCP slow start is operating in the intervals [1,6] and [23,26]*

b) *TCP congestion avoidance is operating in the intervals [6,16] and [17,22]*

c) *After the 16th transmission round, packet loss is recognized by a triple duplicate ACK. If there was a timeout, the congestion window size would have dropped to 1.*

d) *After the 22nd transmission round, segment loss is detected due to timeout, and hence the congestion window size is set to 1.*

e) *The threshold is initially 32, since it is at this window size that slow start stops and congestion avoidance begins.*

f) *The threshold is set to half the value of the congestion window when packet loss is detected. When loss is detected during transmission round 16, the congestion windows size is 42. Hence the threshold is 21 during the 18th transmission round.*

g) *The threshold is set to half the value of the congestion window when packet loss is detected. When loss is detected during transmission round 22, the congestion windows size is 29. Hence the threshold is 14 (taking lower floor of 14.5) during the 24th transmission round.*

h) *During the 1st transmission round, packet 1 is sent; packet 2-3 are sent in the 2nd transmission round; packets 4-7 are sent in the 3rd transmission round; packets 8-15 are sent in the 4th transmission round; packets 16-31 are sent in the 5th transmission round; packets 32-63 are sent in the 6th transmission round; packets 64 – 96 are sent in the 7th transmission round. Thus packet 70 is sent in the 7th transmission round.*

i) *(skipped) The threshold will be set to half the current value of the congestion window (8) when the loss occurred and congestion window will be set to the new threshold value + 3 MSS . Thus the new values of the threshold and window will be 4 and 7 respectively.*

j) *threshold is 21, and congestion window size is 1.*

k) *round 17, 1 packet; round 18, 2 packets; round 19, 4 packets; round 20, 8 packets; round 21, 16 packets; round 22, 21 packets. So, the total number is 52.*

AP43. *In this problem, there is no danger in overflowing the receiver since the receiver's receive buffer can hold the entire file. Also, because there is no loss and acknowledgements are returned before timers expire, TCP congestion control does not throttle the sender. However, the process in host A will not continuously pass data to the socket because the send buffer will quickly fill up. Once the send buffer becomes full, the process will pass data at an average rate or R << S.*

AP44.

a) It takes 1 RTT to increase CongWin from 6 MSS to 7 MSS; 2 RTTs to increase to 8 MSS; 3 RTTs to increase to 9 MSS; 4 RTTs to increase to 10 MSS; 5 RTTs to increase to 11 MSS; 6 RTTs to increase to 12 MSS.

b) In the first RTT 6 MSS was sent; in the second RTT 7 MSS was sent; in the third RTT 8 MSS was sent; in the fourth RTT 9 MSS was sent; in the fifth RTT, 10 MSS was sent; and in the sixth RTT, 11 MSS was sent. Thus, up to time 6 RTT, 6+7+8+9+10+11 = 51 MSS were sent. Thus, we can say that the average throughput up to time 6 RTT was (51 MSS)/(6 RTT) = 8.5 MSS/RTT.