SOLUTION ASSIGNMENT-03 6A

PART-01

REVIEW QUESTIONS

3. Source port number y and destination port number x.

4. An application developer may not want its application to use TCP's congestion control, which can throttle the application's sending rate at times of congestion. Often, designers of IP telephony and IP videoconference applications choose to run their applications over UDP because they want to avoid TCP's congestion control. Also, some applications do not need the reliable data transfer provided by TCP.

7. Yes, both segments will be directed to the same socket. For each received segment, at the socket interface, the operating system will provide the process with the IP addresses to determine the origins of the individual segments.

15. a) 20 bytes b) ack number = 90

18. False, it is set to half of the current value of the congestion window.

PROBLEMS

Problem 3

Note, wrap around if overflow.

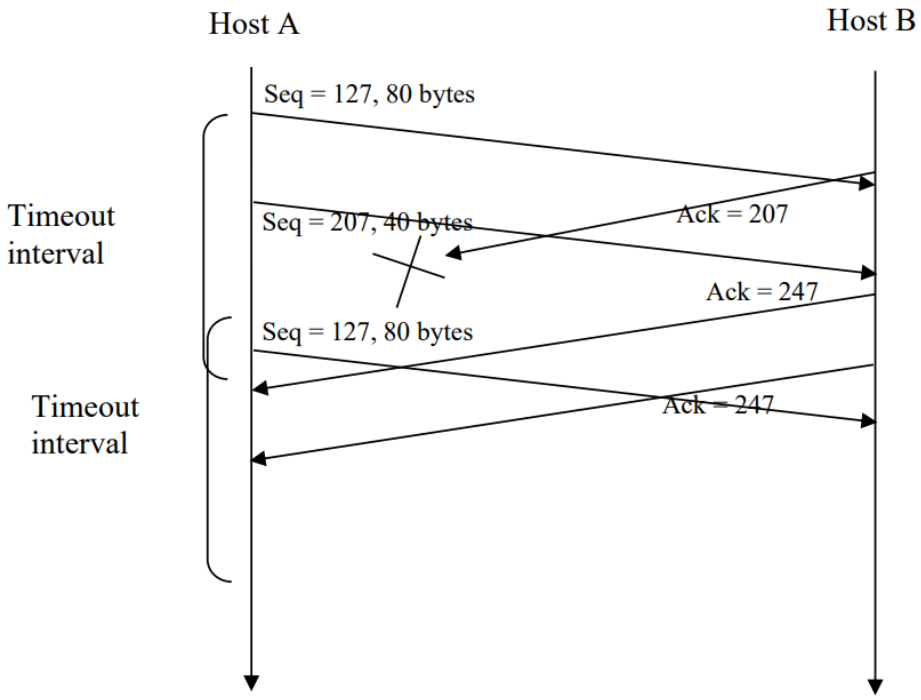
$$\begin{array}{rcccccccc} & 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ + & 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ \hline & 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{array}$$

$$\begin{array}{rcccccccc} & 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ + & 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ \hline & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \end{array}$$

One's complement = 1 1 0 1 0 0 0 1.
To detect errors, the receiver adds the four words (the three original words and the checksum). If the sum contains a zero, the receiver knows there has been an error. All one-bit errors will be detected, but two-bit errors can be undetected (e.g., if the last digit of the first word is converted to a 0 and the last digit of the second word is converted to a 1).

Problem 27

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) 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)



Problem 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

Problem 40

a) TCP slowstart 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) 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.

PART-02

Question 1

a)

Sender window size

= min (Congestion window size, Receiver window size)

= min(4KB , 6KB)

= 4 KB

= 4096 B

b)

Given-

- Last byte acknowledged by the receiver = 8192
- Last byte sent by the sender = 10240

From here,

- It means bytes from 8193 to 10240 are still present in the sender's window.
- These bytes are waiting for their acknowledgement.
- Total bytes present in sender's window = 10240 – 8193 + 1 = 2048 bytes.

From here,

Amount of free space in sender's window currently

= 4096 bytes – 2048 bytes

= 2048 bytes