

## Computer Networks Homework #4

Answer the following questions from your book:

1. R4, page 286
2. R7, page 286
3. R14, page 287
4. P15, page 290. Assume one-way cross country propagation delay of 15 msec.
5. P40, page 296

### Answers

1. 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.
2. 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.
3. a) false b) false c) true d) false e) true f) false g) false.
4. It takes 12 microseconds (or 0.012 milliseconds) to send a packet, as  $1500 \times 8 / 10^9 = 12$  microseconds. In order for the sender to be busy 98 percent of the time, we must have  $util = 0.98 = (0.012n) / 30.012$  or  $n$  approximately 2451 packets.
5.
  - 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 16<sup>th</sup> 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 22<sup>nd</sup> 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 18<sup>th</sup> 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 24<sup>th</sup> transmission round.

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