1. The following figure shows packet sents from a TCP Reno sender. Show what happen after the packet loss for four RTTs. Assume that (1) no more packet loss; and (2) retransmission timeout is longer than two RTTs. (20 pt.)

2. Consider the following three congestion avoidance algorithms for TCP.

   (a) TCP Reno
   \[
   \text{cwnd} += 1/\text{cwnd} \text{ for each successful transmission} \\
   \text{cwnd} /= 2 \quad \text{for each packet loss}
   \]

   (b) New TCP 1
   \[
   \text{cwnd} += 2/\text{cwnd} \text{ for each successful transmission} \\
   \text{cwnd} /= 4 \quad \text{for each packet loss}
   \]

   (c) New TCP 2
   \[
   \text{cwnd} += 0.5/\text{cwnd} \text{ for each successful transmission} \\
   \text{cwnd} /= 1.5 \quad \text{for each packet loss}
   \]

   Derive throughput models for three versions of TCP in the above, and compare them with assumptions that packet loss rate and RTT are the same, and there is no time-out. (20 pt.)

3. Suppose that packets of size 3, 2 and 1 units arrive at a WFQ scheduler at time 0, 0.5 and 1, respectively, on equally weighted connections A, B and C. Also, assume that a packet of size 2 arrives at connection C at time 3. Here note that the link service rate is 1 unit/second. Compute the finish number and time of all the packets. (20 pt.)

4. Suppose that you are an administrator of the Internet Backbone network, and should choose one of RED and BLUE for queue management in your network. Which one are you going to choose, and why?? (10 pt.)

5. Explain how a packet is delivered from a source to a destination in the Internet. First, mention all the related protocols and layers, and explain how they work without consideration of QoS. Then, explain what we need more for QoS support. (30 pt.)