Homework 4.

Due November 2, 2016 before 11:59pm
EECS 325: 39 points + 3 bonus; EECS 425: 42 points

1. Consider a client-server application.

   (a) If the application protocol uses TCP, what information identifies the welcoming socket on the server? **(2pts)**
   (b) Still assuming the application uses TCP, what information identifies a connection socket the server uses to transfer data received from the client to the server application? **(2pts)**
   (c) If the application uses UDP, what information identifies the UDP socket the server uses to transfer data? **(2pts)**

2. TCP protocol standardizes header field sizes so that it would be suitable for a large range of different networks. But assume you are to design a TCP-style protocol for a specific pair of hosts, connected via a 100Mbps network path with RTT of 100ms. The protocol would behave exactly like TCP except you have freedom to change the header field sizes. How many bits should you allocate for the advertised window and sequence number fields in the segment header of your protocol assuming the maximum segment lifetime (i.e., the time you need to allow a segment to wonder around before showing up at the receiver) is 60 seconds? **(3 points)**

3. What is the maximum possible throughput that an application can achieve transmitting an extremely large file using standard (i.e., without optional extensions) TCP over a network with RTT of 50ms? Justify your answer. (Hint: Consider relevant TCP segment header fields, especially their size). **(3 points)**

4. Let us assume some alternative flavors of congestion control.

   a. Assume a congestion control algorithm that still uses additive increase and multiplicative decrease, but instead of reducing sending rate by have after a detected packet loss, the sender would decrease it by ¼. Will this new control converge to fairness under the same assumptions as in the TCP fairness analysis in slide 3 of Lecture notes 13? Why or why not? (Use diagrams similar in that slide, also in Fig. 3.56 in the book, to argue.) **(3 points)**

   b. Assume a new congestion control algorithm that uses additive-increase and also additive decrease, where the sending rate is decreased after a loss by a constant amount, equal to the amount by which it is increased when there is no loss. Will this new control converge to fairness under the same assumptions as in the TCP fairness analysis in slide 3 of Lecture notes 13? Why or why not? (Use diagrams similar in that slide, also in Fig. 3.56 in the book, to argue.) **(3 points)**

5. We saw that assuming the network does not delay segments for too long (basically, as long as the maximum segment life is shorter than the sequence number wrap-around time), GBN needs at least N+1 distinct sequence numbers while SR needs 2N, where N is the window size. TCP inherits ideas from both GBN and SR. How many distinct sequence numbers TCP needs under the same assumptions (i.e., that as the maximum segment life is shorter than whatever the sequence number wrap-around time we decide to have, so the maximum segment life is not an issue), and also assuming the window that maximizes the sequence number space? **(3 points)**

6. Texbook 6th ed. / problem 40 **(18 pts, 2/subproblem)**

EECS 425 only (Bonus for 325):

7. Explain as precisely as you can how delayed acknowledgements will affect the way the congestion window changes during the congestion avoidance phase, assuming the congestion control algorithm as discussed in class. **(3 pts)**