CSC645/745 COMPUTER NETWORKS

Homework 2

Due: 7:00PM, Thursday, 04/07/2016

1. For a communication session between a pair of processes, which process is the client and which is the server? (5 Points)

2. Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that n DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of RTT_1, RTT_2, …, and RTT_n. Further suppose that the Web page associated with the link contains one HTML file and eight very small objects. Let RTT_0 denote the RTT between the local host and the server containing the Web page. Assuming zero transmission time of the HTML file and objects, how much time elapses from when the client clicks on the link until the client receives the whole Web page with non-persistent HTTP? How much time elapses with persistent HTTP? (10 Points)

3. What are the similarities and differences between HTTP and FTP? (10 Points)

4. What are the services provided by TCP? What are the services provided by UDP? (10 Points)

5. In the reliable data transfer protocol, why do we need to use sequence numbers? Why do we need to use ACK/NAK? Why do we need to use timers? (15 Points)

6. Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110. (10 Points)
   a. How much data is in the first segment? (5 Points)
   b. Suppose that the first segment is lost but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what will be the acknowledgment number? (5 Points)

7. Use a client and a server as an example to describe TCP connection establishment (3-way handshake). (10 Points)

8. Host A wants to send 5 segments to Host B. The round trip delay between A and B is 1 second. Host A's timeout period is 2 seconds. We ignore any transmission delay. Suppose the 2rd segment and the 4th segment are each lost once. What is the total time for delivering all the segments from A to B and how many segments does A actually transmit (including retransmission) under each of the following scenarios? (15 points)
   a. Stop-and-Wait
   b. Go-back-N with window size 5
   c. Selective Repeat with window size 5

   Hint: In Go-back-N, the sender maintains only one timer, which is associated with the oldest transmitted but not yet acknowledged segment. If the ACK for the currently oldest transmitted but not yet acknowledged segment is received, the timer is restarted and associated with the next oldest transmitted but not yet acknowledged segment.

9. Host A and B are communicating over a TCP connection, and Host B has already received all bytes up through byte 91 from A. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 8 and 20 bytes of data, respectively. Suppose the two segments sent by A arrive in order at B, and Host B sends an acknowledgment whenever it receives a segment from Host A. (15 points)
   a. Suppose the first acknowledgment is lost and the second acknowledgment arrives BEFORE the first timeout interval. Draw a timing diagram, showing these segments and all other segments and acknowledgments sent. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgment that you add, provide the acknowledgment number.
   b. Suppose the first acknowledgment is lost and the second acknowledgment arrives AFTER the first timeout interval. Redo Problem a.