CS335 Computer Networks (Fall 2020)

Assignment Two (Due on October 9, 2020)

NOTE: *All assignments are to be submitted to UR Courses. Please note that the due time of each assignment is at 10:00 pm (UR Course time) on the due date. Please make sure to "save the changes" after uploading your files. You must delete the uploaded file if you want to upload a new version. All uploaded files will be submitted automatically after the deadline and your update time is your submission time. You will be unable to change your files after deadline.*

You may see partial markings from UR Courses before the completion of marking. Please do not contact the instructor or marker at that time. I will send a mass email after we complete the marking. You should inform me any errors or inconsistencies within a week of the announcement. Any request made more than one week after the announcing date will not be considered.

1. (*0 point*) Read Chapters 2-3.

2. (*10 points*) 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_n. Further suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT_0 denote the RTT between the local host and the server containing the object. Assuming zero transmission time of the object, how much time elapses from when the client clicks on the link until the client receives the object? (*10 points*)

3. (*15 points*) Referring to Question 2, suppose the HTML file references eight very small objects on the same server. Neglecting transmission times, how much time elapses with
    a. Non-persistent HTTP with no parallel TCP connections?
    b. Non-persistent HTTP with the browser configured for 5 parallel connections?
    c. Persistent HTTP?

4. (*15 points*) Consider a short, 10-meter link, over which a sender can transmit at a rate of 150 bits/sec in both directions. Suppose that packets containing data are 100,000 bits long, and packets containing only control (e.g., ACK or handshaking) are 200 bits long. Assume that N parallel connections each get 1/N of the link bandwidth. Now consider the HTTP protocol, and suppose that each downloaded object is 100 Kbits long, and that the initial downloaded object contains 10 referenced objects from the same sender. Would parallel downloads via parallel instances of non-persistent HTTP make sense in this case? Now consider persistent HTTP. Do you expect significant gains over the non-persistent case? Justify and explain your answer.

5. (*15 points*) Consider distributing a file of F bits to N peers using a client-server architecture. Assume a fluid model where the server can simultaneously transmit to multiple peers, transmitting to each peer at different rates, as long as the combined rate does not exceed u_s.
    a. Suppose that $u_s/N \leq d_{min}$. Specify a distribution scheme that has a distribution time of NF/u_s.
    b. Suppose that $u_s/N \geq d_{min}$. Specify a distribution scheme that has a distribution time of F/d_{min}.
    c. Conclude that the minimum distribution time is in general given by $\max\{NF/u_s, F/d_{min}\}$.

6. (*10 points*) In this problem, we use the useful *dig* tool available on Unix and Linux hosts to explore the hierarchy of DNS servers. Recall that in Figure 2.19, a DNS server higher in the DNS hierarchy delegates a DNS query to a DNS server lower in the hierarchy, by sending back to the DNS client the name of that lower-level DNS server. First read the *man* page for dig, and then answer the following questions.
    a. Starting with a root DNS server (from one of the root servers [a-m].rootservers.net), initiate a sequence of queries for the IP address for your department's Web server by using dig. Show the list of the names of DNS servers in the delegation chain in answering your query.
    b. Repeat part a) for several popular Web sites, such as google.com, yahoo.com, or amazon.com.?

7. (*10 points*) Suppose Client A initiates a Telnet session with Server S. At about the same time, Client B also initiates a Telnet session with Server S. Provide possible source and destination port numbers for:
    a. The segments sent from A to S.
    b. The segments sent from B to S.
    c. The segments sent from S to A.
    d. The segments sent from S to B.
    e. If A and B are different hosts, is it possible that the source port number in the segments from A to S is the same as that from B to S?
    f. how about if they are the same host?

8. (*Option, bonus up to 5 points*) Create some review questions in the format of multiple choice, true or false, concept matching, filling blanks, etc. that are suitable for quizzes.

9. (*0 point*) Practise with Wireshark labs.