Homework 3

1. Textbook Chap. 2, P1, page. 171

Explain why the following statement is false?

a. (6%) A user requests a Web page that consists of some text and three images. For this page, the client will send one request message and receive four response messages.
   ANS. Since each connection transports exactly one request message and one response message, there will be four connections.

b. (6%) With non-persistent connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.
   ANS. With non-persistent connection, the connection will close once the first message is received, and there will be a new connection opened to send the second message.

c. (6%) The Date: header in the HTTP response message indicates when the object in the response was last modified.
   ANS. The "Date:" is the time at which the request was created.

d. (7%) HTTP response messages never have an empty message body.
   ANS. Some of HTTP response messages must not include a message body.

2. Textbook Chap. 2, P7, page. 173

(20%) 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 RTT1, …, RTTn. Further suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT0 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?

ANS. The total response time is $2RTT0 + RTT1 + RTT2 + \cdots + RTTn$.

3. Textbook Chap. 2, P8, page. 173

Referring to Problem P7, suppose the HTML file references eight very small objects on the same server. Neglecting transmission times, how much time elapses with

a. (5%) Non-persistent HTTP with no parallel TCP connections?
   ANS. The total response time is $2RTT0*8 + 2RTT0 + RTT1 + RTT2 + \cdots + RTTn$
   $= 18RTT0 + RTT1 + RTT2 + \cdots + RTTn$

b. (5%) Non-persistent HTTP with the browser configured for 5 parallel connections?
   ANS. The total response time is $2RTT0*2 + 2RTT0 + RTT1 + RTT2 + \cdots + RTTn$
   $= 6RTT0 + RTT1 + RTT2 + \cdots + RTTn$

c. (5%) Persistent HTTP?
   ANS. The total response time is $2RTT0 + RTT0 + RTT1 + RTT2 + \cdots + RTTn$
   $= 3RTT0 + RTT1 + RTT2 + \cdots + RTTn$

4. Textbook Chap. 2, P26, page. 177

Suppose Bob joins a Bit Torrent, but he does not want to upload any data to any other peers (so called free-riding).

a. (10%)Bob claims that he can receive a complete copy of the file that is shared by the swarm. Is Bob's claim possible? Why or why not?

   ANS. Yes. As long as there are enough peers staying in the swarm for a long enough time. Bob can always receive data through optimistic unchoking by other peers.

b. (15%)Bob further claims that he can further make his "free-riding" more efficient by using a collection of multiple computers (with distinct IP addresses) in the computer lab in his department. How can he do that?

   ANS. He can run a client on each machine, and let each client do “free-riding”, and combine those collected chunks from different machines into a single file.

5. Textbook Chap. 2, P28, page. 178

(20%) In the circular DHT example in Section 2.6.2, suppose that a new peer 6 wants to join the DHT and peer 6 initially only knows peer 15's IP address. What steps are taken?

ANS. Peer 6 would first send peer 15 a message, requesting “what will be peer 6’s predecessor and successor?” This message gets forwarded through the DHT until it reaches 6’s predecessor and that its current successor, will become 6’s successor. Therefore, Peer 6 can now join the DHT.