COMPUTER NETWORKING
Fall Quarter 2007
Homework # 2 dated Oct. 3, 2007
(Due: Oct. 10, 2007)

The problems from chapter 2

1. **P7**
2. **P8**
3. **P9**

P7. 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 that a DNS look up 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 a RTT of RTT_1, ..., RTT_n. Further suppose that 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?

P8. Referring to Problem P7, suppose the HTML file references three 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 parallel connections?

(c) Persistent HTTP?

P9. Consider Figure 2.12, for which there is an institutional network connected to the Internet. Suppose that the average object size is 900,000 bits and that the average request rate from the institution's browsers to the origin servers is 15 requests per second. Also suppose that the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it received the response is two seconds on average (see Section 2.2.5). Model the total average response time as the sum of the average access delay (that is, the delay from Internet router to institution router) and the average Internet delay. For the average access delay, use $\Delta/(1- \Delta ß)$, where Δ is the average time required to send an object over the access link and ß is the arrival rate of objects to the access link.

a. Find the total average response time
b. Now suppose a cache is installed in the institutional LAN. Suppose the hit rate is 0.4. Find the total response time.