CSEE 4119: Computer Networks

Homework 2 **Due: 02/14/2018, 11:59 pm**

1. (10 points) Suppose you want to do a transaction from a remote client to a server as fast as possible. Would you use UDP or TCP? Why?

2. (10 points) What type of service does the Internet's Transport Layer provide? Does it provide guarantees on minimum throughput or delay?

3. (20 points) Telnet into a Web server and send a multi-line request message. Include in the request message the "If-modified-since:" header line to force a response message with the "304 Not Modified" status code. Report a screenshot of the request message and the response message. Can you identify your IP address in the request or response message?

4. (10 points) Suppose you join BitTorrent without possessing any file chunks. Without any chunks, you cannot become a top-four uploader for any of the other peers, since you have nothing to upload. How then will you get your first chunk?

5. (15 points) Consider an HTML file that references eight very small objects on the same server. Suppose the round trip time for the TCP connection is RTT, and we can neglect transmission times. How much time is required to download the web page, using

   a. Non-persistent HTTP with no parallel TCP connections?

   b. Non-persistent HTTP with the browser configured for 5 parallel connections?

   c. Persistent HTTP?

6. (20 points) In this problem, we use the useful nslookup tool available on Windows, Mac, Unix and Linux, to explore the hierarchy of DNS servers. Open a terminal and enter `nslookup` and then command `set type=ns`. Here is how my terminal looked like

   ```
   C: Javad>nslookup
   Default Server:  Gateway.fios-router.home
   Address:  192.168.1.1

   > set type=ns
   >
   ```

   Now enter `.` to see the list of root DNS servers. How many root DNS servers do you get? Next, enter `edu.` to see the list of TLD DNS servers for edu domain. How many TLD DNS servers do you get? Finally enter a specific domain name like `columbia.edu` to find the authoritative DNS servers for that organization. How many do you get?

   Report a screenshot of your terminal for each case.

7. (15 points) Consider distributing a file of F bits to N peers using a client-server architecture. In class, we found a lower bound on the distribution time. In this problem, we show that the bound is actually tight (equality). 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 $\frac{u_s}{N} \leq d_{min}$. Specify a distribution scheme that has a distribution time of $\frac{NF}{u_s}$.

b. Suppose that $\frac{u_s}{N} \geq d_{min}$. Specify a distribution scheme that has a distribution time of $\frac{F}{d_{min}}$.

c. Conclude that the minimum distribution time is in general equal to $\max\{\frac{NF}{u_s}, \frac{F}{d_{min}}\}$.