Assignment 2: Network Applications[1]

Please submit your answers in a single PDF file.

1. (2 points) True or false?

   a. A user requests a Web page that consists of some text and three images. For this page, the client will send one HTTP request message and receive four HTTP response messages. Assume HTTP/1.1 is used.

   b. With non-persistent connections between browser and origin server, it is possible for a single TCP connection to carry two distinct HTTP request messages.

   c. The `Date: header` in the HTTP response message indicates when the object in the response was last modified.

   d. HTTP response messages never have an empty entity body.

2. (4 points) Consider the following string of ASCII characters that were captured by Wireshark when the browser sent an HTTP GET message (i.e., this is the actual content of an HTTP GET message). The characters <cr><lf> are carriage return and line-feed characters (that is, the italic character string <cr> in the text below represents the single carriage-return character that was contained at that point in the HTTP header). Answer the following questions, indicating where in the HTTP GET message below you find the answer.

```
GET /cs453/index.html HTTP/1.1<cr><lf>Host: gai
a.cs.umass.edu<cr><lf>User-Agent: Mozilla/5.0 (
Windows;U; Windows NT 5.1; en-US; rv:1.7.2) Gec
ko/20040804 Netscape/7.2 (ax) <cr><lf>Accept:ex
t/xml, application/xml, application/xhtml+xml, text
/html;q=0.9, text/plain;q=0.8,image/png,*/*;q=0.5
<cr><lf>Accept-Language: en-us,en;q=0.5<cr><lf>Accept-
Encoding: zip,deflate<cr><lf>Accept-Charset: ISO
-8859-1,utf-8;q=0.7,*;q=0.7<cr><lf>Keep-Alive: 300<cr>
<lf>Connection:keep-alive<cr><lf><cr><lf>
```

   a. What is the **complete URL** (in the format http://.....) of the object requested by the browser?

   b. What version of HTTP is the browser running?

   c. Does the browser request a non-persistent or a persistent connection?

   d. What is the file type of the requested object?

[1] Some questions are adapted from textbooks “Computer Networking: A Top-Down Approach" by James Kurose & Keith Ross and resources provided with the textbooks. They can only be used by students who registered for this course. Reproduction outside of this course use is prohibited.

3. (2 points) Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL has been cached in your local host, so a DNS lookup is not necessary to obtain the IP address. Suppose that the Web page associated with the link contains a small amount of HTML text, and it references to 8 very small objects on the same server. Neglect transmission times and let RTT_w denote the RTT between the local host and the Web server containing the objects. How much time (in terms of RTT_w) elapses
    a. if non-persistent HTTP is used with no parallel TCP connections?
    b. if persistent HTTP is used and requests for referenced objects are sent out back-to-back without waiting for responses for previous requests?
4. (1 point) In BitTorrent, consider a new peer Alice that joins BitTorrent without possessing any chunks. Without any chunks, she cannot become a top-four uploader for any of the other peers, since she has nothing to upload. How then will Alice get her first chunk?
5. (6 points) Consider distributing a file of F = 20 GB to N peers. The server has an upload rate of u_s = 1 Gbps, and each peer has a download rate of d_i = 20 Mbps and an upload rate of u_i. For N = 10, N = 100, or N = 1000, and u_i = 500 kbps, u_i = 5 Mbps, or u_i = 25 Mbps, prepare a table giving the distribution time for each of the combinations of N and u_i for both client-server distribution and P2P distribution. For simplicity, round your results for the distribution time into integers in terms of seconds. (Hint: Pay attention to the units in the question. You can refer to the appendix at the end of this document.)

Distribution time for client/server:

u_i (Mbps)	N = 10	N = 100	N = 1000
0.5			
5			
25			

Distribution time for peer-to-peer:

u_i (Mbps)	N = 10	N = 100	N = 1000
0.5			
5			
25			

Appendix

Table of Units for Data Size.

Unit	Abbreviation	Value
kilobyte	kB	10^3 bytes
megabyte	MB	10^6 bytes
gigabyte	GB	10^9 bytes
terabyte	TB	10^{12} bytes

Table of Units for Data Rate.

Unit	Abbreviation	Value
kilobits/s	kbps, kbit/s	10^3 bits/s
megabits/s	Mbps, Mbit/s	10^6 bits/s
gigabits/s	Gbps, Gbit/s	10^9 bits/s