ECE358: Tutorial Set 2 Solution

**Problem 1.** 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 request message and receive four response messages.b. Two distinct Web pages (for example, www.mit.edu/research.html and www.mit.edu/students.html) can be sent over the same persistent connection.c. With non-persistent connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.d. The Date: header in the HTTP response message indicates when the object in the response was last modified.e. HTTP response messages never have an empty message body.

**Problem 1 Solution:**

a) F

b) T

c) F

d) F

e) F

**Problem 2.** 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 italized 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: gaia.cs.umass.edu<cr><lf> User-Agent: Mozilla/5.0 (Windows;U; Windows NT 5.1; en-US; rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax) <cr><lf> Accept:ext/xml, application/xml, application/xhtml+xml, text/html;q=0.9,t ext/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 URL of the document 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 IP address of the host on which the browser is running?

e. What type of browser initiates this message? Why is the browser type needed in an HTTP request message?

**Problem 2 Solution:**

1. The document request was http://gaia.cs.umass.edu/cs453/index.html. The Host : field indicates the server's name and /cs453/index.html indicates the file name.
2. The browser is running HTTP version 1.1, as indicated just before the first <cr><lf> pair.
3. The browser is requesting a persistent connection, as indicated by the Connection: keep-alive.
4. This is a trick question. This information is not contained in an HTTP message anywhere. So there is no way to tell this from looking at the exchange of HTTP messages alone. One would need information from the IP datagrams (that carried the TCP segment that carried the HTTP GET request) to answer this question.
5. Mozilla/5.0. The browser type information is needed by the server to send different versions of the same object to different types of browsers

**Problem 3.** The text below shows the reply sent from the server in response to the HTTP GET message in the question above. Answer the following questions, indicating where in the message below you find the answer.

HTTP/1.1 200 OK<cr><lf> Date: Tue, 07 Mar 2008 12:39:45GMT<cr><lf> Server: Apache/2.0.52 (Fedora)

<cr><lf>Last-Modified: Sat, 10 Dec2005 18:27:46 GMT<cr><lf> ETag: “526c3-f22-a88a4c80”<cr><lf> Accept-Ranges: bytes<cr><lf> Content-Length: 3874<cr><lf> Keep-Alive: timeout=max=100<cr><lf> Connection: Keep-Alive<cr><lf> Content-Type: text/html; charset=ISO-8859-1<cr><lf><cr><lf> <!doctype html public “-//w3c//dtd html 4.0 transitional//en”><lf> <html><lf> <head><lf> <meta http-equiv=”Content-Type”

content=”text/html; charset=iso-8859-1”><lf> <meta name=”GENERATOR” content=”Mozilla/4.79 [en] (Windows NT 5.0; U) Netscape]”><lf> <title>CMPSCI 453 / 591 /NTU-ST550A Spring 2005 homepage</title><lf> </head><lf> <much more document text following here (not shown) >

a. Was the server able to successfully find the document or not? What time was the document reply provided?

b. When was the document last modified?

c. How many bytes are there in the document being returned?

d. What are the first 5 bytes of the document being returned? Did the server agree to a persistent connection?

**Problem 3 Solution:**

1. The status code of 200 and the phrase OK indicate that the server was able to locate the document successfully. The reply was provided on Tuesday, 07 Mar 2008 12:39:45 Greenwich Mean Time.
2. The document index.html was last modified on Saturday 10 Dec 2005 18:27:46 GMT.
3. There are 3874 bytes in the document being returned.
4. The first five bytes of the returned document are : <!doc. The server agreed to a persistent connection, as indicated by the Connection: Keep-Alive field

**Problem 4.** 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?

**Problem 4 Solution:**

The total amount of time to get the IP address is

.

Once the IP address is known,  elapses to set up the TCP connection and another  elapses to request and receive the small object. The total response time is



**Problem 5.** 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.

Problem 5 Solution:

Note that each downloaded object can be completely put into one data packet. Let Tp denote the one-way propagation delay between the client and the server.

First consider parallel downloads using non-persistent connections. Parallel downloads would allow 10 connections to share the 150 bits/sec bandwidth, giving each just 15 bits/sec. Thus, the total time needed to receive all objects is given by:

(200/150+*T*p + 200/150 +*T*p + 200/150+*T*p + 100,000/150+ *T*p )

+ (200/(150/10)+*T*p + 200/(150/10) +*T*p + 200/(150/10)+*T*p + 100,000/(150/10)+ *T*p )

= 7377 + 8\**T*p (seconds)

Now consider a persistent HTTP connection. The total time needed is given by:

(200/150+*T*p + 200/150 +*T*p + 200/150+*T*p + 100,000/150+ *T*p )

+ 10\*(200/150+*T*p + 100,000/150+ *T*p )

=7351 + 24\**T*p (seconds)

Assuming the speed of light is 300\*106 m/sec, then Tp=10/(300\*106)=0.03 microsec. Tp is therefore negligible compared with transmission delay.

Thus, we see that persistent HTTP is not significantly faster (less than 1 percent) than the non-persistent case with parallel download.

**Problem 6.** Consider the scenario introduced in the previous problem. Now suppose that the link is shared by Bob with four other users. Bob uses parallel instances of non-persistent HTTP, and the other four users use non-persistent HTTP without parallel downloads.

a. Do Bob’s parallel connections help him get Web pages more quickly? Why or why not?

b. If all five users open five parallel instances of non-persistent HTTP, then would Bob’s parallel connections still be beneficial? Why or why not?

### Problem 6 Solution:

1. Yes, because Bob has more connections, he can get a larger share of the link bandwidth.
2. Yes, Bob still needs to perform parallel downloads; otherwise he will get less bandwidth than the other four users.