

Homework Assignment 2

Total Scores 100 (10 for each problem)

Chapter 2: P1, P3, P4, P5, P7, P14, P20,
P22, P23, P24

P1. 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 nonpersistent 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.

- P3. Consider an HTTP client that wants to retrieve a Web document at a given URL. The IP address of the HTTP server is initially unknown. What transport and application-layer protocols besides HTTP are needed in this scenario?

- P4. 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 italicized 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) Gecko/20040804 Netscape/7.2 (ax) <cr><lf>Accept: text/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 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?

- P5. 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 Dec 2005 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 4.0transitional//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-ST550ASpring 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?

- 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 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 $\text{RTT}_1, \dots, \text{RTT}_n$. Further suppose that the 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?

P14. How does SMTP mark the end of a message body? How about HTTP? Can HTTP use the same method as SMTP to mark the end of a message body? Explain.

- P20. Suppose you can access the caches in the local DNS servers of your department. Can you propose a way to roughly determine the Web servers (outside your department) that are most popular among the users in your department? Explain.

- P22. Consider distributing a file of $F = 15$ Gbits to N peers. The server has an upload rate of $u_s = 30$ Mbps, and each peer has a download rate of $d_i = 2$ Mbps and an upload rate of u . For $N = 10, 100$, and $1,000$ and $u = 300$ Kbps, 700 Kbps, and 2 Mbps, prepare a chart giving the minimum distribution time for each of the combinations of N and u for both client-server distribution and P2P distribution.

- P23. Consider distributing a file of F bits to N peers using a client-server architecture. 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 .
- Suppose that $u_s/N \leq d_{\min}$. Specify a distribution scheme that has a distribution time of NF/u_s .
 - Suppose that $u_s/N \geq d_{\min}$. Specify a distribution scheme that has a distribution time of F/d_{\min} .
 - Conclude that the minimum distribution time is in general given by $\max \{ NF/u_s, F/d_{\min} \}$.

- P24. Consider distributing a file of F bits to N peers using a P2P architecture. Assume a fluid model. For simplicity assume that d_{\min} is very large, so that peer download bandwidth is never a bottleneck.
- Suppose that $u_s \leq (u_s + u_1 + \dots + u_N)/N$. Specify a distribution scheme that has a distribution time of F/u_s .
 - Suppose that $u_s \geq (u_s + u_1 + \dots + u_N)/N$. Specify a distribution scheme that has a distribution time of $NF/(u_s + u_1 + \dots + u_N)$.
 - Conclude that the minimum distribution time is in general given by $\max \{ F/u_s, NF/(u_s + u_1 + \dots + u_N) \}$.