Chapter 6

1. The maximum payload of a TCP segment is 65495 bytes. Why was such a strange number chosen?

Maximum IP payload size = 65515 TCP header size ≥ 20 ∴ TCP payload size ≤ 65515 - 20 = 65495

2. If the TCP round-trip time RTT is currently 30 msec and the following acknowledgements come in after 26, 32 and 24 msec, respectively, what is the new RTT estimate using the Jacobson algorithm? Use a = 0.9.

$0.1 \times 30 + 0.9 \times 26 = 26.4$ $0.1 \times 26.4 + 0.9 \times 32 = 31.44$ $0.1 \times 31.44 + 0.9 \times 24 = 24.744$

3. In a network that has a maximum TPDU size of 128 bytes, a maximum TPDU lifetime of 30 sec, and an 8-bit sequence number, what is the maximum data rate per connection?

$2^8 = 256$ ∴ max data rate = $\frac{128 \times 8 \times 256}{30} = 8.74$ kbps

4. To get around the problem of sequence number wrapping around while old packets still exist, one could use 64-bit sequence number. However, theoretically, an optical fiber can run at 75 Tbps. What maximum packet lifetime is required to make sure that future 75 Tbps networks do not have wraparound problems even with 64-bit sequence numbers? Assume that each byte has its own sequence number, as TCP does.

$\frac{75 \times 10^{12}}{8} = 9.375 \times 10^{12}$ sequence number/sec. ∴ Time = $\frac{2^{64}}{9.375 \times 10^{12}} = 1.97 \times 10^6$ s

≈ 22.77 day

∴ the maximum packet lifetime must be less than 22.77 days.

Chapter 7

1. Can a machine with a single DNS name have multiple IP addresses? How could this occur?

Yes. If a machine has two Ethernet cards, it can be on two separate networks, then it has two IP addresses.

2. A binary file is 3072 bytes long. How long will it be if encoded using base64 encoding, with a CR+LF pair inserted after every 80 bytes sent and at the end?

$\lceil \frac{3072}{3} \rceil \times 4 = 4096$ bytes $\lceil \frac{4096}{80} \rceil \times 2 = 104$ bytes

∴ total = 4096 + 104 = 4200 bytes

3. From an ISP's point of view, POP3 and IMAP differ in an important way. POP3 users generally empty their mailboxes every day. IMAP users keep their mail on the server indefinitely. Imagine that you were called in to advise an ISP on which protocol it should support. What considerations would you bring up?

① Storage Requirements: If the server do not have enough space, use POP3.
② Backup and Security: ISP must ensure regular backups and strong security measures if use IMAP.
③ User experience: user can access their email from different device if use IMAP.

4. The standard http URL assumes that the Web server is listening on port 80. However, it is possible for a Web server to listen to some other port. Devise a reasonable syntax for a URL accessing a file on a nonstandard port

The port number can be specified in the URL itself, using the following syntax for URL:

http://[host]:[port]/[path].

5. Imagine that someone in the CS Department at Stanford has just written a new program that he wants to distribute by FTP. He puts the program in the FTP directory ftp/pub/freebies/newprog.c. What is the URL for this program likely to be?

Assume the FTP server hostname is ftp.stanford.edu, then the URL is:

ftp://ftp.stanford.edu/pub/freebies/newprog.c