2

NETWORK STANDARDS

# Homework

First Name:

Last Name:

# Directions

For Test-Your-Understanding Questions

**You must do all in boldface**

~~You do not have to do those that are crossed out~~

You need to know others for the exam but need not do them as homework

You must do all End-of-Chapter Questions that are not crossed out.

Omitting any will result in a severe reduction in your homework grade

Omitting or doing a careless job on any troubleshooting questions will result in a zero for the entire homework.

To answer a question part, place your cursor at the end of the question part and hit Enter

This will put you in the Answer style

Or, click on your answer and hit Alt-Ctrl-A

Save this file as 431 HW C01 *yourname*

E-mail it to panko@hawaii.edu.

# How Internet Standards Came to Be

1. a) Why are Internet standards called RFCs? (Do not just spell out the name.)

b) What factors in the Internet’s informal development process lead to rapid standards development and low-cost products?

# INTRODUCTION

## Standard = Protocol

## Network Standards

## Recap of Chapter 1 Standards Concepts

2. a) Give the definition of network standards that this chapter introduced.

b) In this book, do standards and protocols mean the same thing?

## Network Standard Characteristics

3. **a) What three aspects of message exchanges did we see in this section**?

**b) Give an example not involving networking in which the order in which you do things can make a big difference**.

**c) Distinguish between syntax and semantics**.

# EXAMPLES OF MESSAGE ORDERING

## Message Ordering in HTTP

## Message Ordering and Reliability in TCP at the Transport Layer

4. a) Describe the simple message ordering in HTTP.

**b) In HTTP, can the server transmit if it has not received a request message from the client**?

**c) Describe the three-step handshake in TCP connection openings**.

**d) What kind of message does the destination host send if it does not receive a segment during a TCP connection**?

**e) What kind of message does the destination host send if it receives a segment that has an error during a TCP connection**?

**f) Under what conditions will a source host TCP process retransmit a segment**?

**g) Describe the four-step handshake in TCP connection closes**.

**h) After a side initiates the close of a connection by sending a FIN segment, will it send any more segments? Explain**.

i**) In Figure 2-8, suppose Host A had already sent A6 before it realized that it would need to resend A5. When it then resent A5, A6 would arrive before A5. How would Host B be able to put the information in the two segments back in order**?

**j) Why do we say that TCP is connection-oriented but HTTP is not**?

**k) Why do we say that TCP is reliable**?

# EXAMPLES OF MESSAGE SYNTAX

## Syntax: General Message Organization

5. a) What are the three general parts of messages?

b) What does the data field contain?

c) What is the definition of a header?

d) Is there always a data field in a message?

e) What is the definition of a trailer?

**f) Are trailers common**?

**g) Distinguish between headers and header fields**.

**h) Distinguish between octets and bytes**.

## The Internet Protocol (IP) Packet Syntax

6. **a) How many octets long is an IPv4 header if there are no options? (Look at Figure 2-10**.)

**b) List the first bit number on each IPv4 header row in Figure 2-10, not including options. Remember that the first bit in Row 1 is Bit 0**.

**c) What is the bit number of the first bit in the destination address field in IPv4? (Remember that the first bit in binary counting is Bit 0**.)

d) How long are IPv4 addresses?

**e) What device besides the destination host reads the destination IP address**?

**f) What is this device’s purpose in doing so**?

**g) Is IP reliable or unreliable? Explain**.

## Transmission Control Protocol (TCP) Segment Syntax

Test Your Understanding

7. a~~) Why was TCP designed to be complex?~~

~~b) Why is it important for networking professionals to understand TCP?~~

**c) What are TCP messages called**?

8. **a) Why are sequence numbers good**?

b) What are 1-bit fields called?

c**) If someone says that a flag field is set, what does this mean**?

d) If the ACK bit is set, what other field must have a value?

**e) What is the purpose of the acknowledgment number field**?

## User Datagram Protocol (UDP) Datagram Syntax

9. **a) What are the four fields in a UDP header**?

b) Describe the third.

c) Describe the fourth.

d**) Is UDP reliable? Explain**.

## Port Numbers

Test Your Understanding

10. **a) What type of port numbers do servers use for common server programs**?

**b) What type of port numbers do clients use when they communicate with server programs**?

**c) What is the range of port numbers for each type of port**?

d**) How are ephemeral port numbers generated**?

e**) Why are they called ephemeral**?

11. **a) What is the syntax of a socket**?

**b) In Figure 2-13, when the client transmits to the mail server, what is the source port number**?

**c) What is the destination port number**?

**d) What is the source socket**?

**e) What is the destination socket**?

f**) When the SMTP server transmits to the client host, what is the source port number**?

**g) What is the destination port number**?

**h) What is the source socket**?

i**) What is the destination socket**?

# CONVERTING APPLICATION MESSAGES INTO BITS

12. a) What is encoding?

**b) At what layer is the encoding of application messages done**?

## Encoding Text as ASCII

13. a**) Explain how many bytes it will take to transmit “Hello World!” without the quotation marks. (Check Figure: 12**.)

**b) If you go to a search engine, you can easily find converters to represent characters in ASCII. What are the 7-bit ASCII codes for “Hello world” without the quotation marks? (Check: H is 1001000**.)

## Converting Integers into Binary Numbers (1s and 0s)

Test Your Understanding

14. Answer the following without a calculator.

a) What is an integer?

b) Is 4,307 an integer?

**c) Is 45.7 an integer**?

d**) Convert the binary number 100 to decimal. (Check Figure: 4**.)

**e) Convert the binary number 1111 to decimal**.

**f) Convert the binary number 10110 to decimal**.

**g) Convert the binary number 100100 to decimal**.

**h) Convert the decimal number 8 to binary. (Check Figure: 1000**.)

**i) Convert 6 to binary (Check Figure: 110**.)

**j) Convert 15 to binary**.

**k) Convert 67 to binary**.

## Encoding Alternatives

Equation 1: *a = 2b*, where a is the number of alternatives and b is the number of bits

15. **a) What does the equation *a = 2b* mean**?

b**) How many alternatives can you represent with a 4-bit field? (Check Figure: 16**.)

c**) For each bit you add to an alternatives field, how many additional alternatives can you represent**?

**d) How many alternatives can you represent with a 10-bit field? (With 8 bits, you can represent 256 alternatives**.)

**e) If you need to represent 128 alternatives in a field, how many bits long must the field be? (Check Figure: 7**.)

f**) If you need to represent 18 alternatives in a field, how many bits long must the field be**?

**g) Come up with three examples of things that can be encoded with 3 bits**.

16. **a) In TCP, port number fields are 16 bits long. How many possible port numbers are there**?

**b) IPv4 source and destination address are 32 bits long. How many possible IPv4 addresses are there**?

**c) IPv6 addresses are 128 bits long. How many IPv6 addresses are there**?

**d) The IP version number field is four bits long. How many possible versions of IP can there be**?

**e) UDP length fields are 16 bits long. This field gives the number of bytes in the data field. How many bytes long may a UDP data field be**?

**f) ASCII has a 7-bit code. How many keyboard keys can it represent**?

# VERTICAL COMMUNICATION ON HOSTS

17. a) What is encapsulation?

b) Why is encapsulation necessary for there to be communication between processes operating at the same layer but on different hosts, routers, or switches?

**c) After the internet layer process in Figure 2-18 receives the TCP segment from the transport layer process, what two things does it do**?

d**) After the data link layer process in Figure 2-18 receives the IP packet from the internet layer process, what two things does it do**?

**e) After the physical layer process receives a frame from the data link layer process, what does the physical layer process do**?

**f) If encapsulation occurs on the source host, what analogous process do you think will occur on the destination host? (The answer is not in the chapter**.)

# CONCLUSION

## End-of-Chapter Questions

Thought Questions

2-1. How do you think TCP would handle the problem if an acknowledgment were lost, so that the sender retransmitted the unacknowledged TCP segment, therefore causing the receiving transport process to receive the same segment twice?

2-2 a) What is the minimum number of TCP segments required to send an HTTP request and response message? Justify this number.

b) Repeat the question, this time if the HTTP response message is damaged during transmission.

2-3. a) In Figure 2-13, what will be the value in the destination port number field if a packet arrives for the e-mail application?

b) When the HTTP program on a webserver sends an HTTP response message to a client PC, in what field of what message will it place the value 80?

2-4. Do the following without using a calculator or computer, but check your answers with a calculator or computer. a) Convert 110100 to decimal. (Check Figure: 52.)

b). Convert 001100 to decimal.

c) Convert 7 to binary. (Check Figure: 111.)

d) Convert 47 to binary.

e) Convert 100 to binary.

2-5. Do the following without using a calculator or computer, but check your answers with a calculator or computer. You need to represent 1,026 different city names. How many bits will this take if you give each city a different binary number? Explain your answer.

Brainteaser Questions

Think about these questions, but an answer is not required.

2-6. How can you make a connectionless protocol reliable? (You may not be able to answer this question, but try.)

2-7. Spacecraft exploring the outer planets need reliable data transmission. However, the acknowledgments would take hours to arrive. This makes an ACK-based reliability approach unattractive. Can you think of another way to provide more reliable data transmission to spacecraft without using acknowledgments? (You may not be able to answer this question, but try.)

Perspective Questions

2-8. What was the most surprising thing you learned in this chapter?

2-9. What was the most difficult material for you in this chapter?