

Final Examination

May 27

Be neat and concise. Show your work. Good luck!

Name: _____

| Problem | Points | Score |
|---------|--------|-------|
| 1 | 15 | |
| 2 | 15 | |
| 3 | 15 | |
| 4 | 15 | |
| 5 | 10 | |
| 6 | 15 | |
| 7 | 15 | |
| Total | 100 | |

1. **TCP Congestion Control.** Suppose you are running TCP with a maximum segment size of 1500 bytes. Assume the last acknowledgement received had an acknowledgement field of 500. Give the (new) value of the TCP sending window under the following conditions:

(a) The current congestion window is 3000 bytes, and the current threshold is 4000 bytes. An acknowledgement has just been received with an acknowledgement field of 2000 and a window field of 5000.

(b) Same conditions as part (a) except the acknowledgement field is 1000.

(c) Same conditions as part (a) except the current threshold is 2000 bytes.

2. Reliability.

- (a) Draw a client-server timing diagram to illustrate the Sorcerer's Apprentice bug. Annotate the diagram to explain why each packet is sent.

- (b) Explain one mechanism to fix this bug.

3. **DNS/Sockets programming.** The manual page for `gethostbyaddr()` has the following synopsis:

```
struct hostent *gethostbyaddr(const char *addr, int len, int type);
```

The structure `hostent` is as follows:

```
struct hostent {
    char    *h_name;           /* canonical name of host */
    char    **h_aliases;      /* alias list */
    int     h_addrtype;       /* host address type */
    int     h_length;         /* length of address */
    char    **h_addr_list;    /* list of addresses */
};
```

- (a) In one sentence, what does `gethostbyaddr()` do?
- (b) List the steps involved when a program makes a call to `gethostbyaddr()`. Clearly state what entities/systems are involved and what each does.

4. **Short answer — Application-layer protocols.** Give concise answers to the following:

(a) Why does FTP use separate connections for data and control?

(b) How does a TFTP client know when it has received the entire file?

(c) Define the term *proxy*.

5. **Protocol design.** Give a concise argument for **or** against the addition of sequence numbers to the T3PO protocol.

6. **HTTP.** Consider an HTML document that contains a base object with three imbedded objects. Assume that the objects are all small enough that transmission time is negligible. Give the minimum number of round trip times needed to transfer the base object and imbedded objects under the following scenarios. Briefly explain each answer.

(a) Non-persistent connections

(b) Persistent connections without pipelining

(c) Persistent connections with pipelining

7. Byte ordering.

- (a) Consider the following code:

```
struct {  
    u_char a;  
    u_char b;  
    u_short c;  
    u_long d;  
} msg;
```

```
msg.a = 0x64; msg.b = 0x75; msg.c = 0x1234; msg.d = 0x98765432;
```

If `msg` is sent from a big-Endian machine to a little-Endian machine without doing any byte swapping on either end, what will the values be of each field at the receiving machine?

- (b) Give the code fragment for each end (sender and receiver) needed to do the necessary byte swapping.