

CS 485/ECE 440/CS 585 Fall 2013 Midterm

Name: _____

This test is open book and open notes, but closed neighbor and closed everything else except for a pen or pencil. If you are logged into any lab computer or other computer that is connected to the Internet or using any devices such as a cell phone during the exam you will receive a 0 on the exam and I may take further action pursuant to University policy about cheating. Kindles are okay as long as wireless is disabled and you don't use any modes besides viewing the book and/or viewing your notes.

Write all answers on the front or back of this sheet, you will tear off this page and only turn in this page (both front and back). None of these are meant to be trick questions, if the question seems simple it probably is. If it's not clear which selection you marked, I'll mark it as incorrect.

For questions 1 through 17 circle the correct answer (A, B, C, or D) below:

- | | | | | | | | | | |
|----|---|---|---|---|-----|---|---|---|---|
| 1. | A | B | C | D | 9. | A | B | C | D |
| 2. | A | B | C | D | 10. | A | B | C | D |
| 3. | A | B | C | D | 11. | A | B | C | D |
| 4. | A | B | C | D | 12. | A | B | C | D |
| 5. | A | B | C | D | 13. | A | B | C | D |
| 6. | A | B | C | D | 14. | A | B | C | D |
| 7. | A | B | C | D | 15. | A | B | C | D |
| 8. | A | B | C | D | 16. | A | B | C | D |

For question 17, write your answer on the back of this sheet of paper. Your answer cannot be more than one page, and no part of it should be written anywhere else than the back of this sheet of paper, so that all your answers for the entire midterm are all on the front or back of this one sheet of paper. Answer the undergraduate version of question 17 if you are registered for CS 485 or ECE 440, answer the graduate version if you are registered for CS 585.

Write your answer for question 17 here:

DON'T CIRCLE ANSWERS HERE, CIRCLE THEM ON THE ANSWER SHEET.

1. Assuming a subnet mask of 255.255.128.0, which of these IP addresses is NOT on the same subnet as 67.89.34.12?:

A. 67.89.127.253 B. 67.89.134.253 C. 67.89.34.13 D. 67.89.1.1

2. Assuming a /17 subnet, which of these IP addresses is NOT on the same subnet as 67.89.34.12?:

A. 67.89.127.253 B. 67.89.134.253 C. 67.89.34.13 D. 67.89.1.1

3. Roughly how many IP addresses are there in a /18 subnet?

A. 256 B. 4096 C. 16,348 D. 262,144

4. If machine A wants to send a packet to a machine on another subnet, B, through gateway router C, which of these would I expect to find in the Ethernet (*i.e.*, link layer) header of the packet sent by A?

- A. A's IP address
- B. B's Ethernet address (a.k.a. MAC address)
- C. C's Ethernet address (a.k.a. MAC address)
- D. C's IP address

5. If machine A wants to send a packet to a machine on another subnet, B, through gateway router C, which of these would I expect to find in the IP (*i.e.*, network layer) header of the packet sent by A?

- A. A's IP address
- B. B's Ethernet address (a.k.a. MAC address)
- C. C's Ethernet address (a.k.a. MAC address)
- D. C's IP address

6. Which of these is not a property of UDP?

- A. Connectionless
- B. Unreliable from the application layer's perspective
- C. Based on the abstraction of a stream socket
- D. The header includes a checksum

For questions 7 through 11, please refer to the following system call trace excerpts...

```
---snip---
socket(PF_INET, SOCK_STREAM, IPPROTO_IP) = 3
bind(3, {sa_family=AF_INET, sin_port=htons(5000),
sin_addr=inet_addr("0.0.0.0")}, 16) = 0
listen(3, 10) = 0
```

```

accept(3, 0, NULL) = 4
...
write(4, "Sat Sep 21 13:53:33 2013\r\n", 26) = 26
close(4) = 0
...
accept(3, 0, NULL) = 4
stat("/etc/localtime", {st_mode=S_IFREG|0644, st_size=2427, ...}) = 0
write(4, "Sat Sep 21 13:54:45 2013\r\n", 26) = 26
close(4) = 0
...
accept(3, 0, NULL) = ? ERESTARTSYS (To be
restarted)
---snip---

```

7. Which machine is this system call trace most likely from?:

- A. A server B. A client C. A router D. A switch

8. How many client connections are apparent in this system call trace?

- A. 1 B. 2 C. 4 D. None

9. What is the file descriptor number (*i.e.*, the index in the file descriptor table) for the listening socket?

- A. 1 B. 2 C. 3 D. 4

10. What is the file descriptor number (*i.e.*, the index in the file descriptor table) for the first client connection socket?

- A. 1 B. 2 C. 3 D. 4

11. What is the file descriptor number (*i.e.*, the index in the file descriptor table) for the last client connection socket?

- A. 1 B. 2 C. 3 D. 4

12. Which of these best describes the purpose of the port numbers that we can find in UDP or TCP headers?

- A. The port number identifies a unique transport layer protocol
- B. The port number identifies the version of the transport layer protocol
- C. The port number is decremented at every hop
- D. The port number helps the receiving kernel identify a process/socket for the packet

13. If a TCP sender has 14,600 bytes of data in-flight (*i.e.*, it has sent those bytes but has not yet received acknowledgment for any of them), which of these statements is NOT NECESSARILY true?

- A. The congestion window size of the sender is at least 10 MSS's (or, 14,600 bytes)
- B. The congestion window size of the receiver is at least 10 MSS's (or, 14,600 bytes)
- C. The sender is expecting acknowledgment packets from the receiver
- D. The flow control window advertised by the receiver to the sender is at least 14,600 bytes

14. Which of these is the reason why a TCP Reno machine in Slow Start or Congestion Avoidance would enter the Fast Recovery state?

- A. A timeout event
- B. Duplicate ACK acknowledgments
- C. The receiver sent a message to cut ssthresh in half
- D. The congestion window increased to the point of reaching ssthresh

15. If you're carrying out a statistical hypothesis test, such as a t-test, and you fail to reject the null hypothesis, what can you conclude?

- A. No strong evidence about whether the null or alternate hypotheses are true or false
- B. The null hypothesis is true
- C. The alternate hypothesis is false
- D. The alternate hypothesis is true

16. What does it mean if you see multiple HTTP requests in the same TCP flow?

- A. The connection was reset
- B. The time-to-live (TTL) field in the IP header was anomalous
- C. The HTTP connection was persistent
- D. Jed is hungry for 川菜 (this is not the correct answer, Jed is always hungry for 川菜)

17. (undergraduate version, for CS 485 and ECE 440 students): Tell me the whole process of going to Google and carrying out a search, in terms of everything that happens on my computer and how it uses the network. In other words, what are the steps involved for my web browser process to talk to Google's web server process and submit my search and then display the results. Assume a TCP/IP network where the local network is Ethernet. You should go into enough detail to make sure you cover every layer of the OSI stack (physical, link, network, transport, and application) and identify the most important steps, but no need to give extraneous details. Don't forget to

delineate the roles of the userspace process and the kernel. Your answer should be about half a page.

17. (graduate version, for CS 585 students): Describe a design for TCP congestion control for an IP network for our solar system (*e.g.*, with routers on Saturn, Pluto, Uranus, *etc.*). Assume the underlying network is IP and the routers are based on the end-to-end philosophy. Also assume that layers 1 and 2 (the physical and link layers) have been taken care of for you (so no need to worry about the physics of getting a frame from a router on Saturn to a router on Uranus). You can't change anything about the TCP protocol other than the congestion control. For example, you can't change the TCP header. You can change things like how to handle duplicate ACK's, timeout values, how the congestion window is managed, etc. Hint: it takes hours for a message traveling at the speed of light to cross the solar system, so you should assume a *very* high delay.