

CS 485/ECE 440/CS 585 Fall 2011 Midterm

Name: _____

This test is closed book, closed notes, closed neighbor, closed everything except for a pen or pencil. If you are logged into any lab computer that is connected to the Internet or using any devices such as a cell phone or calculator during the exam you will receive a 0 on the exam and I may take further action pursuant to University policy about cheating.

Write all answers on this sheet, you will tear off this page and only turn in this page. None of these are 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.

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|-------|---|---|----|---|---|----|---|---|
| 1. a. | T | F | f. | T | F | k. | T | F |
| b. | T | F | g. | T | F | l. | T | F |
| c. | T | F | h. | T | F | m. | T | F |
| d. | T | F | i. | T | F | n. | T | F |
| e. | T | F | j. | T | F | o. | T | F |
| 2. a. | T | N | c. | T | N | e. | T | N |
| b. | T | N | d. | T | N | | | |
| 3. | | | | | | | | |

Please do not write on this page. It is a place holder so you can turn in your answer sheet face down.

1. Answer the following questions by circling T for true or F for false:
 - a. The purpose of TCP flow control is to stop the sender and receiver from overwhelming the network routers with traffic when lots of others are using the network.
 - b. ARP is a broadcast protocol, but sometimes switches and learning bridges cause ARP packets to only be sent to ports that need to see them.
 - c. Distance vector routing is more scalable than link-state routing in the sense that distance vector routing doesn't require each node to have a complete picture of the entire network.
 - d. Modern implementations of TCP that support fast retransmit sometimes acknowledge the same sequence numbers more than once.
 - e. An operating system kernel cannot know what TCP socket a received packet is intended for without looking at both the source and destination ports.
 - f. Assuming IPv4 as the layer 3 protocol, 192.168.33.45 and 192.168.33.189 are on the same subnet if both have a subnet mask of 255.255.255.224.
 - g. Assuming IPv4 as the layer 3 protocol, 192.168.33.45 and 192.168.98.12 are on the same subnet if both have a subnet mask of 255.255.0.0 (i.e., Class B subnet).
 - h. TCP guarantees that the receiver's socket will deliver data to the application in the same order that the sending application wrote it into the sender's socket.
 - i. UDP also guarantees that the receiver's socket will deliver data to the application in the same order that the sending application wrote it into the sender's socket.
 - j. Modern implementations of the TCP protocol adapt to network conditions to make sure that the sender backs off and sends less traffic when less bandwidth between the sender and receiver is available.
 - k. Modern implementations of the UDP protocol adapt to network conditions to make sure that the sender backs off and sends less traffic when less bandwidth between the sender and receiver is available.
 - l. A TCP sender has to check both the flow control window and the congestion control window to make sure there is room to send more in-flight data in both before sending more data.
 - m. In a full factorial experimental design with 3 factors and two levels per factor, there are always 8 replications for each run/treatment.
 - n. It's considered bad experimental design to do your experiments in random order, you should always block them into logical blocks.
 - o. Fractional factorial designs are useful when there are many factors, each with two levels, and we want to learn what factors are the most important to look at more closely.

2. Consider the data about students' fingers that we collected in class and the conclusions we drew from doing t-tests. Here are the hypotheses and the t-test results:

Hypothesis 1: People's middle fingers are longer than their pinky fingers (null hypothesis is that people's middle fingers and pinky fingers are the same length).

P-value for a pooled, unpaired t-test: 9.41×10^{-20}

Hypothesis 2: People's ring fingers are longer than their index fingers (null hypothesis is that people's ring fingers and index fingers are the same length).

P-value for a pooled, unpaired t-test: 0.385

Hypothesis 3: Graduate students' thumbs are longer than undergraduate students' thumbs (null hypothesis is that people's middle fingers and pinky fingers are the same length).

P-value for a pooled, unpaired t-test: 0.197

Recall that the names of the fingers from thumb to pinky are thumb, index, middle, ring, pinky.

Also recall that the P-value is the probability of observing data at least as extreme as the data you observed assuming that the null hypothesis is true, where extreme refers to how much the two observed samples means differ.

Assume that we only reject the null hypothesis for P-values less than 0.05.

For each of the following statements mark T for true if the statement is okay to say, or N for not necessarily true if there's something wrong with the statement so that it's not okay to say that way.

- a. By rejecting the null hypothesis for Hypothesis 1, we can say with high confidence that there is a statistically significant difference between the lengths of middle fingers and pinky fingers.
- b. By failing to reject the null hypothesis for Hypothesis 3, we can say with high confidence that graduate student thumbs and undergraduate thumbs are the same length, with statistical significance.
- c. Assuming that Hypothesis 2 were true (I'm pretty sure it is), we might be able to confirm it and successfully reject the null hypothesis by taking more accurate and consistent measurements and collecting a lot more data.
- d. Assuming that Hypothesis 3 was not true, if we collected data from a different set of students it's possible that we still might reject the null hypothesis by chance.
- e. Based on the data and P-value for Hypothesis 1, there's a 5% probability that the average middle finger in the class is no longer than the average pinky, and that our results are just due to measurement error.

3. For question number 3, answer (a) if you are registered for CS 485 or ECE 440, and answer (b) if you are registered for CS 585. You only need to answer the one question for your section.

Write your answer on the answer sheet (page 1), not here. Your answer should be at most three sentences and should be written legibly.

(a) Question for undergraduates (those registered for CS 485 or ECE 440): Explain how packet loss can lead to the receiver of a TCP connection receiving data out of order.

(b) Question for graduate students (those registered for CS 585): Suppose two TCP connections share only a single IP router in their route (*e.g.*, one connection is from New York to Los Angeles and the other is from Seattle to Miami, and their routes only cross at a single IP router in Denver.). If this IP router is congested, what guarantee about fairness does it make to the two different TCP connections?

Write your answer on the answer sheet, don't write it here.

Trivia questions (just for fun, worth no points, write anywhere on your answer sheet):

Who was the other founder of Apple besides Steve Jobs?

What famous Palo-Alto-based club did he and Jobs present the Apple I to in 1975 that generated buzz about the Apple I's graphics capabilities?

What was the price of the Apple I?