STA 198F, Fall 2020: Probabilities Everywhere

Class activities for Week 9

Reminder – Final essay (essay.pdf): Ideas are due by email by 4:00 PM on Nov. 30, to be discussed in class on Dec. 2. The final papers are due at 4:00 PM on Dec. 8. So, start thinking about your essays now! And, don't forget about the available library and writing centre assistance, listed in item #4 at the bottom of the course web page.

Whole-class homework discussion: As a group, we will discuss last week's homework readings and questions. Be sure to participate actively, and raise your hand often!

Class Warm-Up Exercise About P-values:

1. Suppose someone claimed they had psychic powers, and that if a tester selected one of three different objects, then they could GUESS which of the three objects it was. According to current scientific practice, how many correct guesses in a row would they need before you believed that they had this power?

Group Exercise About P-values:

First, <u>each</u> member of your group should find three small distinct objects in their home (like three different coins, or three different chess pieces, or three different coloured pens, etc.), to use when you are the "tester". Once you have each found your objects, then working cooperatively with your group, consider the following questions:

2. Have <u>each</u> member of your group try <u>each</u> of the following guessing games (with <u>no</u> cheating), <u>each</u> for the number of times determined above, keeping track of all the results:

(a) The tester (another student) secretly selects one of their three items, and holds it up high while keeping it hidden.

(b) The group member stares at the computer screen.

(c) The group member guesses which object it is.

(d) The tester checks to see if they were correct.

3. Repeat question #2, replacing step (b) by:

(b′) The group member runs their fingers over the computer screen.

4. Repeat question #2, replacing step (b) by:

(b″) The group member deeply inhales the air near the computer screen.

5. Consider the group members and methods, if any, which did manage to guess correctly the appropriate number of times in a row. Do you believe that this result <u>proves</u> that they do indeed have psychic powers? Why or why not? (If there were <u>no</u> such students and methods, then answer this question <u>pretending</u> that there were.)

6. In what ways are these students and methods analogous to medical studies about new pharmaceutical drugs? What trick does this experiment suggest that pharmaceutical companies could employ, if they were desperate to get a new drug approved? Explain.

7. What steps could be taken to try to prevent pharamceutical companies from employing this trick? How successful do you think they would be?

8. What further experiments could be done, to further clarify whether these successful students and methods actually correspond to psychic powers? What do you think the results would be? How is this related to cases where a certain medical "fact" is established by one study, but then later contradicted by another study?

9. (If time.) Suppose someone claims they can <u>usually</u> (not always) guess the correct object. They take the test described in question #2, 10 times in a row, and guess correctly 9 times (and wrong one time). What is the p-value corresponding to this experiment? What would you conclude from this experiment, and why?

Homework assignment:

Read the book from the middle of page 106 (beginning with "Publication Bias") to the bottom of page 115 (ending with "resembling a free society"). While you are reading, consider and make notes about the following questions.

1. What is "publication bias"?

2. Summarise at least <u>two</u> of the stories about each of: asking your mom/dad; Happiness Hats; Dr. Nancy Olivieri; Dr. Betty Dong; and Vioxx. What do these stories all have in common? What can we learn from them?

3. What did the International Committee of Medical Journal Editors declare in 2001? How is it related to publication bias? Do you feel that it will completely solve the problem of bias in medical studies? Why or why not?

4. What does it mean that "correlation does not imply causation"?

5. Summarise at least <u>two</u> of the stories about each of: the Jumping Frog; cigarettes and yellow stains; the Meditation Medical Miracle; the medical school class presidents; and television versus violence. What do these stories all have in common? What can we learn from them?

6. What are "randomized trials"? How do they relate to correlation and causation? Do you think they solve all problems of interpreting causation? Why or why not?

7. The next time your doctor tells you to take a certain drug or action because studies prove it is beneficial, how will you react? Why?

8. Suppose you had a bad cold, and a doctor wanted you to take a certain pill. Suppose a medical study had determined that the pill would cure your cold immediately, and was perfectly safe. However, there was probability p that the study's conclusions were invalid. How small would p have to be, before you would agree to take the pill? Why?