STA 198F, Fall 2020: Probabilities Everywhere

Class activities for Week 8

Reminders:

No class on Nov. 11 (Reading Week); next class is Nov. 18.

Final essay: Ideas due by email on Nov. 30; to be discussed in class on Dec. 2; papers due Dec. 8. So, start thinking about it now! And don't forget about the Library and Writing Centre assistance available to you; see the links on the bottom of the course web page.

Election Prediction Competition discussion (preliminary).

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!

Group Utility Functions Exercise (attached).

Homework assignment:

Read the book from page 96 to the middle of page 106 (ending with "... publicize their product"). While you read, consider (and make brief notes about) the following questions:

1. Summarise the "Lucky Shot?" story. What answer would you give to the boyfriend at the end?

2. What does it mean to "just get lucky"?

3. What are p-values? (Give as much detail as you can.)

4. What is the "5% standard"? Do you feel that 5% is an appropriate standard? Why or why not? Does it depend what is being studied?

5. Discuss the various calculations related to the Probabilitus example and the candies example.

6. In the Probabilitus example, suppose instead that 70 patients out of 100 were cured. Do you think this would this "prove" that the drug works? Why or why not? What mathematical quantity would be important for determining this?

7. What is the principle of "regression to the mean", why does it arise, and what examples does the book provide?

8. Explain "sampling bias" and "reporting bias". Summarise the book's examples of them.

9. Think of two additional examples of bias, from your own life or the news (not from the book), and describe what effects the bias might have.

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Group Utility Functions Exercise

FIRST: You should all introduce yourselves to each other, and chat for a few minutes about your background, studies, etc. You may wish (optional) to exchange social media or contact information (either verbally or through private chat messages), to hopefully make friends that you can contact outside of class.

THEN: As a group, consider and discuss the following questions about utility functions.

1. As a group, discuss appropriate utility values for the following events, on a scale where seeing a pretty good movie is +10. [You may either have one utility function for the entire group (if you all agree), or separate utility functions for each group member (if you do not agree), but be sure to DISCUSS the values as a group. Also, note that "having to pay $x" will probably have negative utility; it means that you would agree to buy an item for $x if and only if that item's positive utility was more than this negative utility.] (a) Eating a delicious meal; (b) Going on a pleasant three-hour cruise on Lake Ontario; (c) Getting a bad cold for three days; (d) Having to pay $1; (e) Having to pay $10; (f) Having to pay $100.

2. Based solely on the utility values from the previous question, decide whether or not you would accept each of the following offers: (i) Paying $1 for a delicious meal; (ii) Paying $10 for a delicious meal; (iii) Paying $100 for a delicious meal; (iv) Paying $10 for a pleasant three-hour cruise on Lake Ontario; (v) Paying $100 for a pleasant three-hour cruise on Lake Ontario; (vi) Getting a delicious meal, for free, in exchange for contracting a bad cold for three days. (vii) Getting a pleasant three-hour cruise on Lake Ontario, for free, in exchange for contracting a bad cold for three days.

3. Decide whether or not you would accept the following offers involving randomness, again based on your utility functions. (i) Paying $10 to have probability 50% of having a delicious meal; (ii) Paying $1 to have probability 50% of having a delicious meal; (iii) Paying $1 to have probability 1% of having a delicious meal; (iv) Having a delicious meal, in exchange for having probability 50% of having to pay $10; (v) Having a delicious meal, in exchange for having probability 50% of having to pay $100; (vi) Having a delicious meal, in exchange for having probability 1% of having to pay $100.

4. Make up your own example of a difficult life choice, that could perhaps be solved using utility functions.

FINALLY: If you have time, then consider the remaining questions below. Assume throughout that the scale for utility functions is such that seeing a pretty good movie is +10.

5. Suppose Frank gives utility −50 to getting caught in the rain.

(a) Would Frank choose to walk to a pretty good movie in the rain?

(b) Would Frank choose to walk to a pretty good movie if there was a 50% chance of rain during the walk?

(c) Would Frank choose to walk to a pretty good movie if there was a 10% chance of rain during the walk?

(d) Would Frank choose to walk to a pretty good movie if there was a 20% chance of rain during the walk?

6. Suppose George says that he wouldn't walk to a pretty good movie in the rain, but he *would* walk to a pretty good movie if there was a 70% chance of rain during the walk. What does this say about George's utility for getting caught in the rain?

7. Suppose Harry *says* that he gives utility -50 to getting caught in the rain, but you think he *really* gives utility -100 to getting caught in the rain. What hypothetical choice could you give him, to determine whether his utility was really -50 or -100?

8. Suppose Igor doesn't know (or won't tell you) *what* utility he gives to getting caught in the rain. However, for any probability p, he will answer Yes or No if you ask him whether he would choose to walk to a pretty good movie if there was probability p of rain during the walk. Could you figure out Igor's utility for getting caught in the rain, to within ± 1? How?

9. Suppose Jerome says that he wouldn't walk to a pretty good movie in the rain, nor would he walk to a pretty good movie if there was a 20% chance of rain during the walk, but he *would* walk to a pretty good movie if there was a 70% chance of rain during the walk. What does this say about Jerome?