

P8122 Homework 1

Due: 09/13/2022 at 5:00pm

Instructions

- Upload a single pdf file for your homework on Canvas.
- You may discuss these problems with each other verbally, but must write up the answers on your own, and may not share or show your answers to anyone else.
- Short and clear answers, please.
- No late homework are allowed.

Question 1

Consider the following population of individuals and suppose we knew all the potential outcomes:

Table 1: Counterfactuals

Individual	Y_0	Y_1
1	0	0
2	1	0
3	0	1
4	1	0
5	1	0
6	0	1
7	1	0
8	0	0

- (a) 5 points. For all individuals calculate the effect of treatment on the outcome and interpret.
- (b) 5 points. Calculate the average causal effect of treatment on the outcome and interpret.
- (c) 10 points. Calculate the association of the treatment with the outcome under the following treatment assignment for subjects $i = 1, \dots, 8$: $A_1 = 1, A_2 = 0, A_3 = 1, A_4 = 1, A_5 = 0, A_6 = 0, A_7 = 0, A_8 = 1$. Interpret the result, compare with the effect computed in question 2b.
- (d) 10 points. Show a random assignment of the treatment for this population. Explain your work. Compute the association of the treatment with the outcome under the random assignment and compare with the treatment effect computed in question 1b.

Question 2

During a check-up, a physician finds that his patient's blood pressure levels are too low. He prescribes medication at a high dose and asks her to be re-tested in a month. At the second test, the patient's blood pressure levels are now too high, so the physician switches her to a low dose of medication and again asks her to be re-tested in a month. At the third test, the patient's blood pressure levels are perfect, and so the doctor decides that she should stay at the low dose indefinitely, with no further testing.

- (a) 5 points. What are the units?
- (b) 5 points. What is the treatment?
- (c) 10 points. What are the potential outcomes?
- (d) 10 points. Show the calculation that the physician conducts to conclude that the patient should remain on the low dose (compute the causal effect of the treatment).
- (e) 10 points. Is SUTVA plausible? If so, explain why briefly. If not, offer an assumption that, if true, would make SUTVA plausible. (Remember that SUTVA has two parts).
- (f) 10 points. Why must SUTVA be plausible in order for us to use the potential outcome framework?
- (g) 10 points. Does the physician's assignment mechanism appear to be probabilistic? Individualistic? Unconfounded? and controlled? Explain in one sentence each.
- (h) 10 points. How would you assign in this single subject study the treatment differently in order to validly compute the causal effect of treatment.