Causal Inference - Homework 1

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Question 1:

1. We choose a “naive” treatment that is .

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Index | X | T |  |  | Y |
| 1 | 0 | 0 | 0 | 1 | 0 |
| 2 | 1 | 0 | 0 | 1 | 0 |
| 3 | 0 | 0 | 0 | 1 | 0 |
| 4 | 1 | 1 | 1 | 2 | 2 |
| 5 | 0 | 1 | 1 | 2 | 2 |
| 6 | 1 | 1 | 1 | 2 | 2 |

2. By using the same example above, we will get.

Question 2:

1. Let

We assume Consistency: so for T=t we get that (\*)

Ignorability: (\*\*)

The inner expression:

We plug back into the original expression and we get:

1. We will denote the covariate vector for a pregnant woman and we know that in the trial there were no pregnant women, so:

This means is undefined (division by zero), and the same for .

That information violates the positivity of the trial, and we cannot say anything about the causal effect that the drug has on pregnant women.

Question 3:

1. The SUTVA assumption does **NOT** hold.

For example, in treatments Y00000010 and Y00000011, the only change is that ‘Steph Curry’ got a basketball, but it affects ‘Seth Curry’, who got 0 in the first treatment and 1 with the second one.

1. Because each family in our data has 2 kids, and we assume the SUTVA holds between the different families, we can define the treatment as the number of basketballs each family got. For a family with kids i,j we can write the new treatment as .

And the potential outcomes, that is, the number of children who got a full scholarship in each family - .

1. First, we will create an updated table:

|  |  |  |  |
| --- | --- | --- | --- |
|  | (0) | (1) | (2) |
| Ball | 0 | 1 | 0 |
| Plumlee | 0 | 2 | 0 |
| Lopez | 0 | 1 | 0 |
| Curry | 0 | 0 | 2 |