Causal Inference - Exercise 1

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Question 1

Using potential outcomes notation, give an example of a data generating process (a joint distribution) which includes a hidden confounder H, a binary treatment t, and two potential outcomes Y_0 and Y_1, such that:

1. Ignorability does *not* hold, and

2. $\mathbb{E}[Y_1 - Y_0] \neq \mathbb{E}[Y|t = 1] - \mathbb{E}[Y|t = 0]$, where $Y = t \cdot Y_1 + (1 - t) \cdot Y_0$

Answer

Consider the following setup:

1. $x \sim Ber(q)$

2. $T|x \sim Ber(p_1 x + p_2(1 - x))$

And Y is a linear function of x, T: $Y = 4T + 4x$
W conclude that:

- $Y_0 = 4x$

- $Y_1 = 4 + 4x$

First let us show that ignorability does not hold:

$$p$$

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