HOMEWORK #3 — CS262Z

J. Pearl
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1. Prove (by counterexample) that the properties expressed in Eqs. (1.38) and (1.39) are not sufficient for ensuring that a DAG is a causal Bayesian network.
2. Prove that Property 2, Eq. (1.39), holds in every causal model, not necessarily Markovian, while Property 1 (Eq. (1.38)) holds in Markovian models.
3. Prove that, in every causal model (including non-Markovian), only descendants of X_i can be influenced by manipulating X_i; i.e., $P_x(y) = P(y)$ whenever Y is a nondescendant of X.
4. What other properties of Makovian models hold in non-Markovian models.

5. Modify Model-2 (Eq. (1.48)) by assuming that U_1 and U_2 are not independent but, rather, that a person curable by the treatment is three times more likely to seek treatment than a person allergic (fatally) to the treatment, and $P(u_2 = 1) = \frac{1}{2}$.

   (a) Compute that probability that a treated person would recover.

   (b) Define and compute the population rate of recovery if we make the treatment mandatory to all.

   (c) Suppose Joe died, and we do not know whether he was treated or not.

      c1. Compute the probability that Joe was treated.

      c2. Compute (formally) the probability that Joe died BECAUSE he was treated. (Use the 3-step procedure on page 37.)