

ICS 275B
Homework Assignment 8
Spring 2005

Instructor: Rina Dechter

Due: Monday, June 13th

Relevant reading: Pearl's Causality book chapters 1 and 3.

1. Read chapter 1. Given a fragment of a Bayesian network between 3 variables U, X and Y with arcs $U \dashrightarrow X$, $U \dashrightarrow Y$ and $X \dashrightarrow Y$. Add two variables to the network Z and W such that the following three conditions hold simultaneously:
 - Z and X are dependent given W , and
 - Z and U are independent given W .
 - Z and W are ancestors of Y but not of X .
2. Prove that the properties expressed in Eqs. (1.38) and (1.39) follow from definition 1.3.1 (see slides set 1)
3. Prove that only descendants of X_i can be influenced by manipulating X_i .
4. Consider the following semi-Markovian model (see slides set 2)

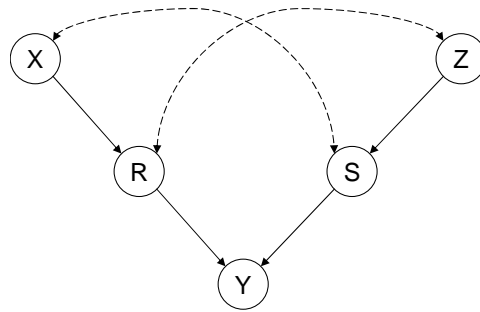


Figure 1: A Bayesian network

- (a) Test whether the causal effect $P(y|do(z))$ is identifiable. If the answer is yes, provide an expression for $P(y|do(x), do(z))$. If the answer is no, prove it directly.
- (b) List the causal effects that are identifiable in the model above. State your reasoning for each.
- (c) Can you think of a real-life problem having this structure?