CSE 250A Quiz 2

Tuesday October 16, 2012

Instructions. You should do this quiz in partnership with exactly one other student. Write both your names at the top of this page. Discuss the answer to the question with each other, and then write your joint answer below the question. It is ok if you overhear other students' discussions, because you still need to decide if they are right or wrong. You have seven minutes.

(a) Consider a Bayesian network with three nodes A, B, and J and two edges, $J \to A$ and $J \to B$. Are A and B conditionally independent? Are A and B unconditionally independent?

Answer. Yes, they are independent conditional on J. No, they are unconditionally dependent.

(b) Suppose that the nodes are binary random variables. Let $A = 1$ mean Alice is late, let $B = 1$ mean Bob is late, and let $J = 1$ mean there is a traffic jam. Alice and Bob do not know about each other, and never influence each other to be late or not. Explain how your answers to part (a) are consistent with this scenario.

Answer. If there is a traffic jam, it affects each of them independently. However, if one is late, that provides information about whether there has been a jam, so it provides information about whether the other is likely to be late, so they are not unconditionally independent.

Additional comments. The following argument is incorrect: "Alice and Bob never influence each other, so they are unconditionally independent." Lack of influence does not imply independence. Essentially, independence is lack of information flow. If one person is late, that does provide information about whether the other is likely to be late.

The edges $J \to A$ and $J \to B$ represent the intuition that the traffic jam influences Alice and it influences Bob, but conditional on the jam, they are independent. The surprising consequence is that Alice and Bob are then not independent.