Philosophy 12: Introduction to Causal Reasoning
Answer key for Lecture 15 study questions

1. Answers: (a), (b), (e), and (f) The reason (c) is not correct is that graph 3 implies that $X \not\perp\!\!\!\perp Y \mid Z$, because the only causal connection between X and Y involves Z, and conditioning on any variable on a causal connection prevents it from producing association. Choice (d) is incorrect for the same reason.

2. Answers: (a) and (e) Choice (b) is not correct because graph 2 is inconsistent with the information that X is prior to Y, and the same holds for graph 6 (choice (f)). Choices (c) and (d) are not correct because, in each case, the graph implies that $X \not\perp\!\!\!\perp Y \mid Z$ since the only causal connection between X and Y involves Z, and conditioning on any variable on a causal connection prevents it from producing association.

3. Answer: (b) Remember, ideal interventions on causes don't change the relationship between the cause and its effects. Neither (c) nor (d) are correct because these two graphs represent an intervention on INCOME, not EDUCATION. (a) is incorrect because we are considering an intervention on EDUCATION, which is a cause of INCOME in the pre-manipulation graph, and interventions on causes do not change the relationship between the cause and its effects.

4. Answer: (c) Remember, ideal interventions on effects change the relationship between the effect and its causes. In these case we are intervening on EDUCATION, which is an effect of L in graph 3. Choice (a) is not correct because we are considering an intervention on EDUCATION, which does nothing to the relationship between L and Income. The reason choice (b) is incorrect is that the graph does not represent and intervention on EDUCATION.

5. Answer: (d)

6. Answers: (a) and (c) Two variables A and B are causally connected if A is a cause (direct or indirect) of B, B is a cause of A, or if there is a common cause of both A and B. The reason choice B is incorrect is that although L was a common cause of EDUCATION and INCOME in the pre-manipulated graph, since the arrow from L to EDUCATION was broken by the intervention, EDUCATION and INCOME are no longer causally connected in the post-manipulation graph.

7. Answers: (a) and (c) A graph produces an association between variables A and B if there are any causal connections between A and B. Choice B is incorrect because EDUCATION and INCOME are not causally connected in the post-manipulation graph, so they will not be associated.

8. Answers: (a), (d), (e), and (g) For an undirected path between A and B to be a causal connection it must either be a directed path or a common cause. Choice (b) is incorrect because in graph 2, Y no longer causes X, so there is no longer a directed path from Y to X. Choice (c) is incorrect because in graph 3, L no longer causes X, so L is no longer a common cause of X and Y. Lastly, choice (f) is incorrect because in graph 6, L no longer causes X, so L is no longer a common cause of X and Y, and Y no longer causes X, so there is no longer a directed path from Y to X.

9. Answers: (a), (d), (e), and (g) Remember that A and B will be associated if there is a causal connection between them.

10. Answer: (a) Choice (b) is not correct because Y is a cause of X in some of the pre-manipulation graphs, but the intervention on X eliminates the connection betwen X and any cause of X. The reason (b) is not correct is that L is a common cause of X and Y in some of the pre-manipulation graphs, but the intervention on X eliminates the connection L to X, so L is no longer a common cause in any post-manipulation graph.

11. Answers: (b) and (c) The reason (a) is incorrect is that an intervention on X does not affect the relationship between X and its effects, so it will do nothing to a causal path from X to Y.

12. Answer: (d) The only evidence we have is that whiteness of teeth is associated with number of dates. This evidence alone supports (a), (b), and (c).

13. Answer: (e) There are probably many causes of teenage boys getting dates besides the whiteness of their teeth. Since Jones used so few subjects in his study, the slight association could be explained by any number of these uncontrolled causes.

14. Answer: (a)

15. Answer: (b)

16. Answers: (a) and (b) EDUCATION and INCOME must be causally connected in the post-manipulation graph. Both graphs (a) and (b) will contain a causal connection between EDUCATION and INCOME after an ideal intervention on EDUCATION.

17. Answer: (c)