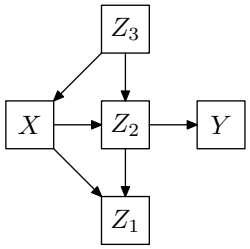
Philosophy 12: Introduction to Causal Reasoning
Causation to Conditional Association study questions

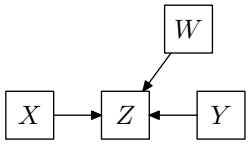
1. Consider the causal graph below.



   Which of the following undirected paths produce an association between X and Y?

   (a) $X \leftarrow Z_3 \rightarrow Z_2 \rightarrow Y$
   (b) $X \rightarrow Z_2 \rightarrow Y$
   (c) $X \rightarrow Z_2 \rightarrow Z_1 \leftarrow Y$
   (d) $X \rightarrow Z_1 \leftarrow Y$
   (e) $X \rightarrow Z_1 \leftarrow Z_2 \rightarrow Y$

2. In the following causal graph, which pairs of variables are connected by an undirected path?



   (a) X and Y
   (b) X and W
   (c) X and Z
   (d) Y and W
   (e) Y and Z
   (f) W and Z
   (g) None of the above

3. In the same causal graph, which pairs of variables are connected by a *directed* path in either direction?

   (a) X and Y
   (b) X and W
   (c) X and Z
   (d) Y and W
   (e) Y and Z
   (f) W and Z
   (g) None of the above

4. On an undirected path that is a causal connection:

(a) All variables are common causes.
(b) All variables are mediators.
(c) All variables are common effects.
(d) All variables are common causes or mediators.
(e) All variables are common causes or common effects.
(f) All variables are common effects or mediators.

5. The highest number of common causes that can occur on a single path that is a causal connection is:

(a) 0
(b) 1
(c) 2
(d) 3
(e) There is no upper bound.

6. The highest number of mediators that can occur on a single path that is a causal connection is:

(a) 0
(b) 1
(c) 2
(d) 3
(e) There is no upper bound.

7. On the path $X \rightarrow Y \rightarrow Z_1$

(a) Y is a collider.
(b) Y is a non-collider.
(c) Y is neither a collider nor a non-collider.

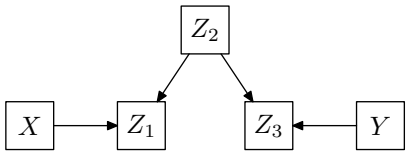
8. On the undirected path $X \rightarrow Y \leftarrow Z_2 \rightarrow Z_1$

(a) Y is a collider.
(b) Y is a non-collider.
(c) Y is neither a collider nor a non-collider.

9. On an undirected path that is a causal connection:

(a) All variables are colliders.
(b) All variables are non-colliders.
(c) Some variables are colliders an some are non-colliders.

10. Consider the graph below:



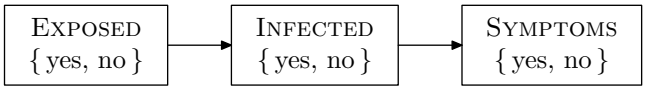
Which variables are colliders on the only path between X and Y?

(a) Z_1

(b) Z_2

(c) Z_3

11. Consider the following graph corresponding to the chicken pox example discussed in class.



Are EXPOSED and SYMPTOMS predicted to be *associated* by this graph?

(a) Yes

(b) No

(c) Not enough information to tell

12. Suppose I claim that EXPOSURE and SYMPTOMS are independent conditional on INFECTION among American 3-year olds. To check my claim, you would need to confirm that (Circle all that apply):

(a) Fr(SYMPTOMS = yes) = Fr(SYMPTOMS = yes | EXPOSURE = yes)

(b) Fr(SYMPTOMS = yes) = Fr(SYMPTOMS = yes | EXPOSURE = yes)

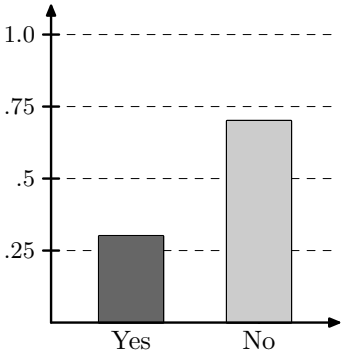
(c) Fr(SYMPTOMS = yes | INFECTION = yes) = Fr(SYMPTOMS = yes | INFECTION = yes, EXPOSURE = yes)

(d) Fr(SYMPTOMS = yes | INFECTION = No) = Fr(SYMPTOMS = No | INFECTION = no, EXPOSURE = no)

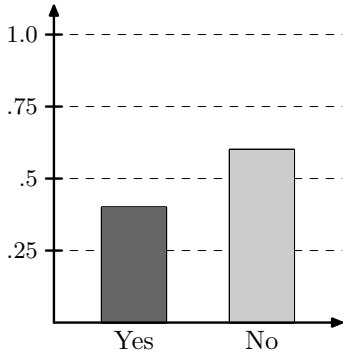
(e) None of the above

13. Which two of the following histograms should you examine to determine whether the properties EXPOSED = yes and SYMPTOMS = yes are independent conditional on INFECTION = yes?

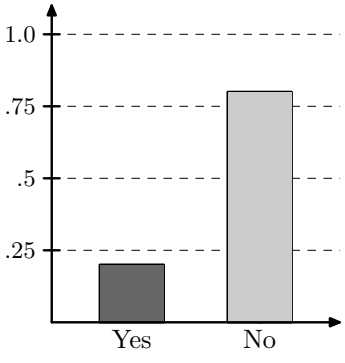
(a) Fr(SYMPTOMS | EXPOSURE = no & INFECTION = yes)



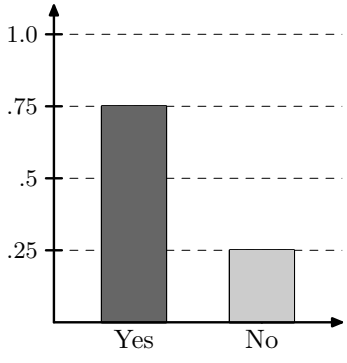
(c) Fr(EXPOSURE | INFECTION = Yes)



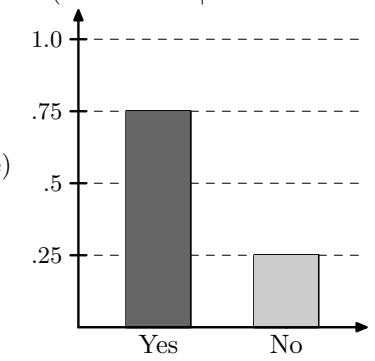
(b) Fr(SYMPTOMS | INFECTION = Yes)



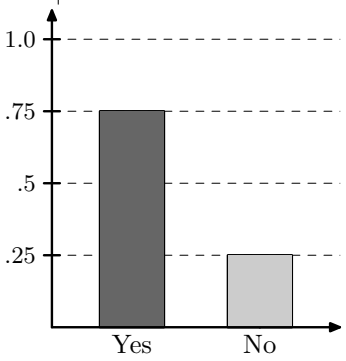
(d) Fr(INFECTION | EXPOSURE = Yes)



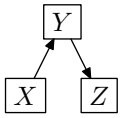
(e) Fr(Symptoms | Infection = No)



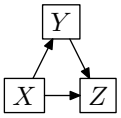
(f) Fr(Symptoms | Exposure = Yes & Infection = No)



Consider the two causal graphs below:

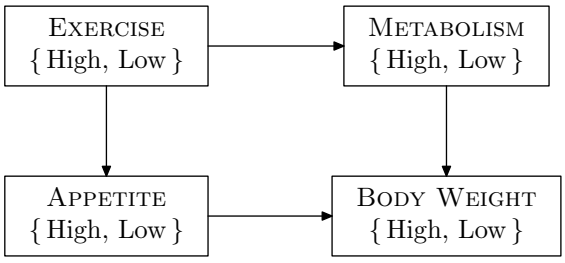


Causal Graph A



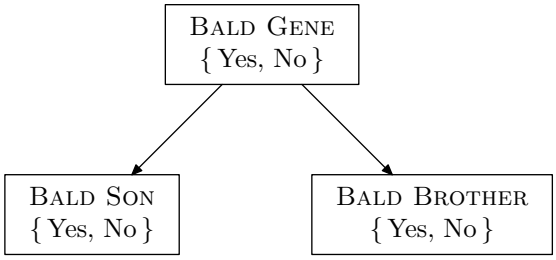
Causal Graph B

14. Which of the following variable pairs are causally connected in graph A?
    (a) X,Y
    (b) X,Z
    (c) Y,Z
15. Which of the following variable pairs are causally connected in graph B?
    (a) X,Y
    (b) X,Z
    (c) Y,Z
16. Do both graphs lead to the same predictions about independence and conditional independence?
    (a) Yes
    (b) No
17. Using the graph below, predict what independence relations will hold.



    (a) Exercise $\not\perp\!\!\!\perp$ Body Weight
    (b) Exercise $\not\perp\!\!\!\perp$ Body Weight | Appetite
    (c) Exercise $\not\perp\!\!\!\perp$ Body Weight | Metabolism
    (d) Exercise $\not\perp\!\!\!\perp$ Body Weight | Appetite, Metabolism

18. According to the causal graph:



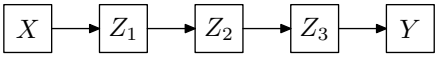
Are Bald Son and Bald Brother predicted to be associated?

(a) Yes

(b) No

(c) Not enough information to tell

19. According to the causal graph:



Which of the following independence relations are predicted to hold?

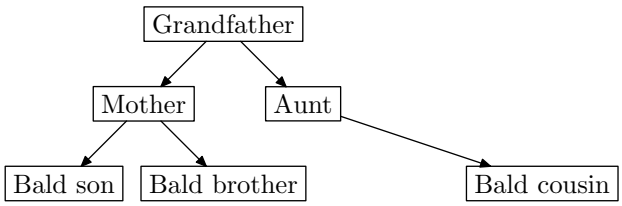
(a) $X \perp\!\!\!\perp Y$

(b) $X \perp\!\!\!\perp Z_2 \mid Z_1$

(c) $X \perp\!\!\!\perp Z_3 \mid Z_2$

(d) $Z \perp\!\!\!\perp Y \mid Z_3$

20. Consider the following causal graph:



Which of the following independence relations are predicted to hold by this graph?

(a) Bald son $\perp\!\!\!\perp$ Bald Cousin

(b) Bald son $\perp\!\!\!\perp$ Bald Cousin | Grandfather

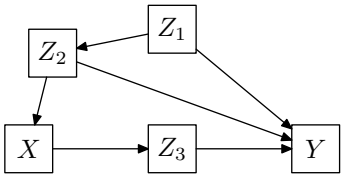
(c) Bald son $\perp\!\!\!\perp$ Bald Cousin | Bald Brother

(d) Bald son $\perp\!\!\!\perp$ Bald Cousin | Mother

(e) Bald son $\perp\!\!\!\perp$ Bald Cousin | Mother, Aunt

(f) Bald son $\perp\!\!\!\perp$ Bald Cousin | Aunt

21. Consider the following causal graph:



Which of the following independence relations are predicted to hold in this graph?

(a) $X \perp\!\!\!\perp Y$

(b) $X \perp\!\!\!\perp Y \mid Z_1$

(c) $X \perp\!\!\!\perp Y \mid Z_2$

(d) $X \perp\!\!\!\perp Y \mid Z_3$

(e) $X \perp\!\!\!\perp Y \mid Z_1, Z_3$

(f) $X \perp\!\!\!\perp Y \mid Z_2, Z_3$

(g) $X \perp\!\!\!\perp Y \mid Z_1, Z_2$

(h) $X \perp\!\!\!\perp Y \mid Z_1, Z_2, Z_3$