P6 Study questions

3.3.1

Vector criterion. There are two conditions

- Blocks all vector paths from cause to effect
- The set may not include any descendant of the cause

Study question 3.3.1

Consider the graph in Figure 3.8:

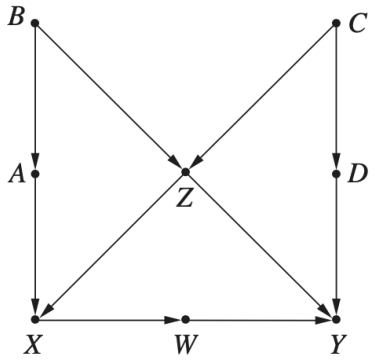

Figure 3.8 Causal graph used to illustrate the backdoor criterion in the following study questions

(a) List all of the sets of variables that satisfy the backdoor criterion to determine the causal effect of X on Y.
(b) List all of the minimal sets of variables that satisfy the backdoor criterion to determine the causal effect of X on Y (i.e., any set of variables such that, if you removed any one of the variables from the set, it would no longer meet the criterion).
(c) List all minimal sets of variables that need be measured in order to identify the effect of D on Y. Repeat, for the effect of $\{W, D\}$ on Y.

a) W is descendant of X; we need to condition on Z then, this is the only way. We can block any one of those four nodes A,B,C,D; or all together even, or two or three.

- Z is a fork, normally the path is open. In order to block it, we need to condition on it.

b) Any set needs to involve Z. Minimal sets:

- {Z,A}; {Z,B}; {Z,C}; {Z,D}

c1) Blocking paths = deseparation

- {C}; {Z,B}; {Z,A}; {Z,X}; {Z,W}
- All sets are minimal.

c2) It must block all vector paths going from either W or D going to Y

- We need to condition for both paths at the same time.
- Both paths are blocked when we condition on {Z}. No other paths are opened up by that.
- If we looked at them separately, some paths open up.

- Another minimal set is {C,X} when we look at them separately.

3.5.1

Study question 3.5.1

Consider the causal model of Figure 3.8.

(a) Find an expression for the c-specific effect of X on Y.

(b) Identify a set of four variables that need to be measured in order to estimate the z-specific effect of X on Y, and find an expression for the size of that effect.

(c) Using your answer to part (b), determine the expected value of Y under a Z-dependent strategy, where X is set to 0 when Z is smaller or equal to 2 and X is set to 1 when Z is larger than 2. (Assume Z takes on integer values from 1 to 5.)