

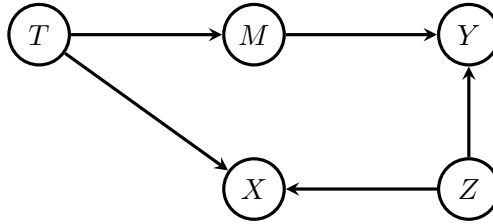
Statistics 256: Causality

In-class Activity 1: DAGs Part 1

Name(s): _____

Question 1: *d*-separation

Consider the following DAG:



- (a) List all paths between T and Y (ignoring arrow direction).
- (b) Is T *d*-separated from Y given $\emptyset$ (i.e. unconditionally)? Explain.
- (c) Is T *d*-separated from Y given $\{M\}$? Explain.
- (d) Is T *d*-separated from Y given $\{X\}$? Explain.
- (e) Is T *d*-separated from Y given $\{M, X\}$? Explain.

Question 2: Draw the DAG

For each scenario below, draw a DAG that encodes the causal relationships described. Label every node clearly. You can use a variable "U" for unobserved things you may not have a good name for, though if you can think of something specific, all the better.

- (a) A researcher wants to know if having more police reduces crime, but the data show that cities with more police actually have more crime. Draw a DAG indicating what might be happening.
- (b) A hiring committee selects candidates based on a combined assessment of interview performance and resumé quality. An analyst examines only the hired candidates and finds that, among them, those with stronger resúmes appear to have performed worse in interviews. Draw a DAG that explains this pattern. Which node is being conditioned on?

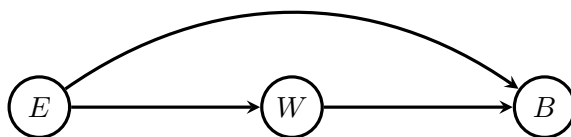
Question 3: Two researchers, two DAGs

Two researchers are studying the relationship between exercise (E), weight (W), and blood pressure (B). They agree on the variables but disagree about the causal structure.

Researcher 1 believes exercise affects weight, and weight affects blood pressure:



Researcher 2 believes exercise affects both weight and blood pressure directly, and weight also affects blood pressure:



- (a) Under Researcher 1's DAG, is $E \perp\!\!\!\perp B \mid W$? Under Researcher 2's DAG, is $E \perp\!\!\!\perp B \mid W$?
- (b) Based on your answers, describe a pattern you could look for in data to help distinguish between these two graphs.