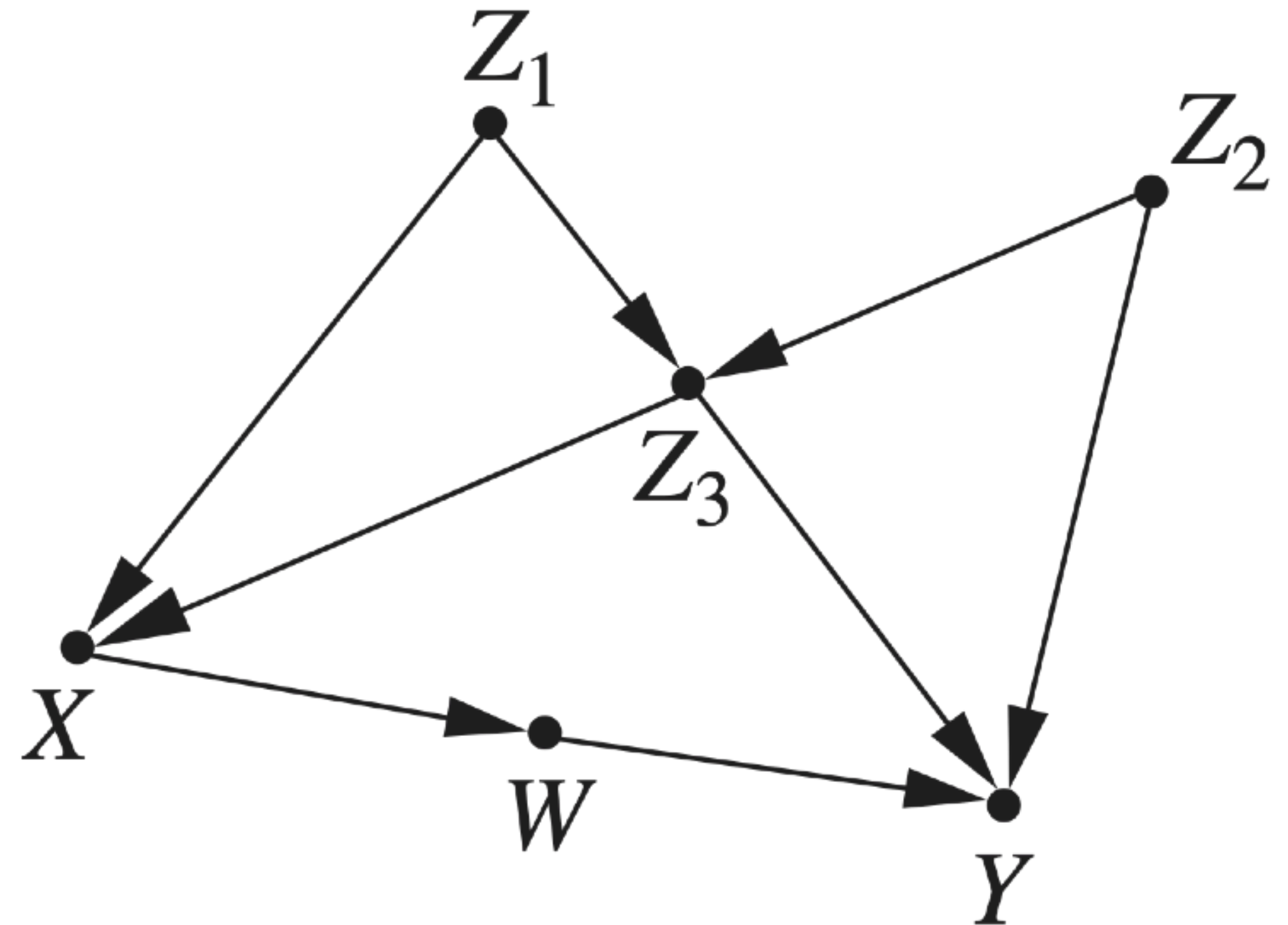


Open and closed paths

- Paths containing **uncontrolled** pipes and forks are **open**
- Paths containing **colliders are closed by default**, but **open if we condition** on the collider
- To estimate the true causal effect of x on y , we need all non-causal paths from x to y to be closed in our model

Identify all the open paths from X to Y



Back door criterion

To estimate the causal effect of X on Y , identify a set of control variables such that no descendants (mediators) of X are in the control set, and all paths between X and Y that contain an arrow into X are blocked.