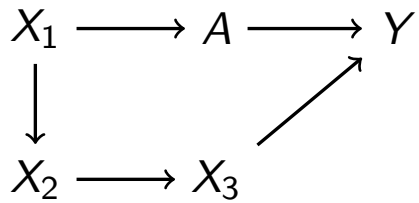
Exercise 1

Find adjustment sets that identify the effect of A on Y



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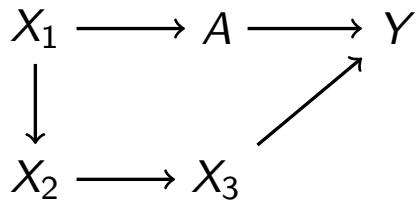

We can block the backdoor path in several ways:

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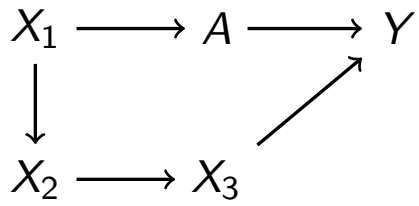

We can block the backdoor path in several ways:

- Condition on X_1: $A \leftarrow \boxed{X_1} \rightarrow X_2 \rightarrow X_3 \rightarrow Y$

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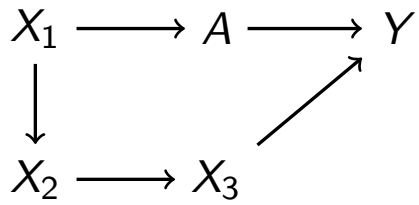

We can block the backdoor path in several ways:

- Condition on X_1: $A \leftarrow \boxed{X_1} \rightarrow X_2 \rightarrow X_3 \rightarrow Y$
- Condition on X_2: $A \leftarrow X_1 \rightarrow \boxed{X_2} \rightarrow X_3 \rightarrow Y$

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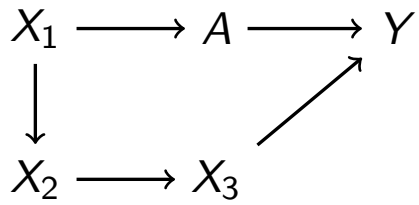
Find adjustment sets that identify the effect of A on Y



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- Condition on X_1: $A \leftarrow \boxed{X_1} \rightarrow X_2 \rightarrow X_3 \rightarrow Y$
- Condition on X_2: $A \leftarrow X_1 \rightarrow \boxed{X_2} \rightarrow X_3 \rightarrow Y$
- Condition on X_3: $A \leftarrow X_1 \rightarrow X_2 \rightarrow \boxed{X_3} \rightarrow Y$

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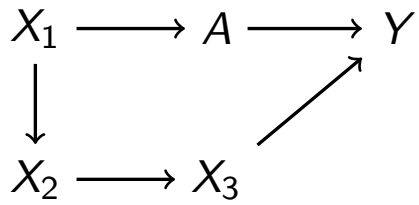

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- Condition on X_1: $A \leftarrow \boxed{X_1} \rightarrow X_2 \rightarrow X_3 \rightarrow Y$
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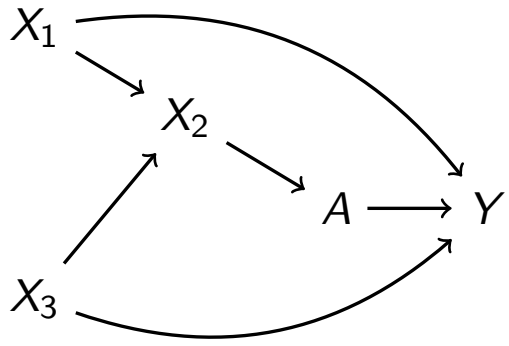
- Condition on X_3: $A \leftarrow X_1 \rightarrow X_2 \rightarrow \boxed{X_3} \rightarrow Y$
- Any combination of the above

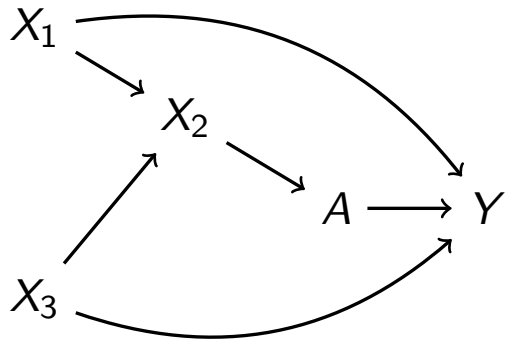
Exercise 2

Find 3 sufficient adjustment sets to identify $A \rightarrow Y$



Exercise 2

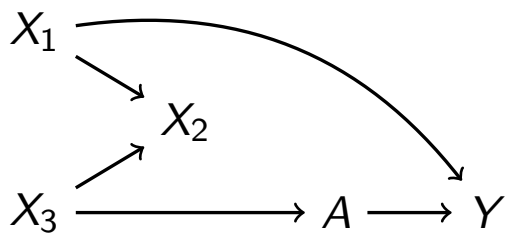
Find 3 sufficient adjustment sets to identify $A \to Y$



Answer: $\{X_2\}, \{X_1, X_3\}, \{X_1, X_2, X_3\}$

Exercise 3

What is the smallest adjustment set that identifies $A \to Y$?



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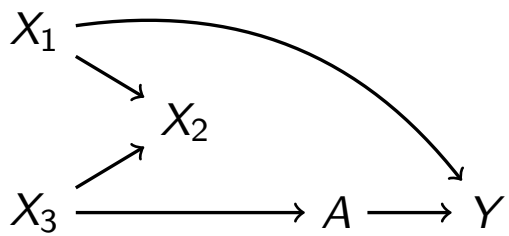

Answer: The empty set! Don't condition on anything.
The collider X_2 already blocks the path.