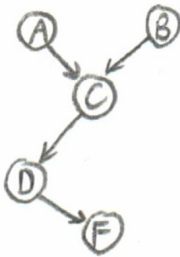
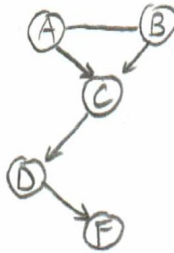


1. Are A and B conditionally independent, given D and F?
 (Same as " $P(A|BDF) =? P(A|DF)$ " or " $P(B|ADF) =? P(B|DF)$ ")

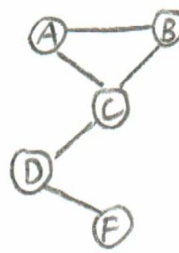
Draw ancestral graph



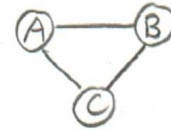
Moralize



Disorient



Delete givens



Answer: No, A and B are connected, so they are not required to be conditionally independent given D and F.

2. Are A and B marginally independent? (Same as " $P(A|B) =? P(A)$ " or " $P(B|A) =? P(B)$ ")

Draw ancestral graph



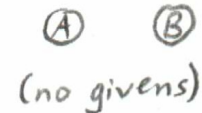
Moralize



Disorient



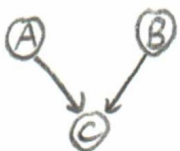
Delete givens



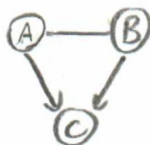
Answer: Yes, A and B are not connected, so they are marginally independent.

3. Are A and B conditionally independent, given C?

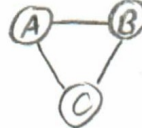
Draw ancestral graph



Moralize



Disorient



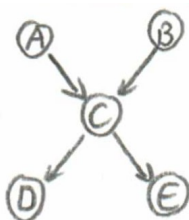
Delete givens



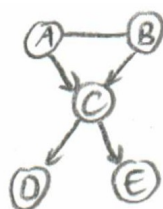
Answer: No, A and B are connected, so they are not required to be conditionally independent given C.

4. Are D and E conditionally independent, given C?

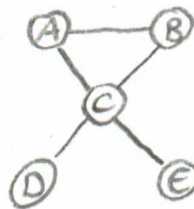
Draw ancestral graph



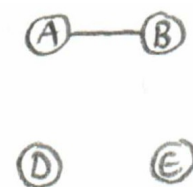
Moralize



Disorient



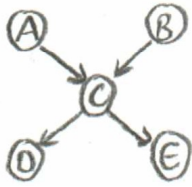
Delete givens



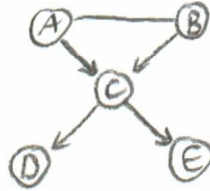
Answer: Yes, D and E are not connected, so they are conditionally independent given C.

5. Are D and E marginally independent?

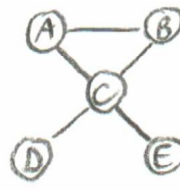
Draw ancestral graph



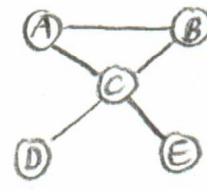
Moralize



Disorient



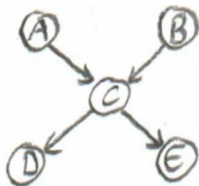
Delete givens



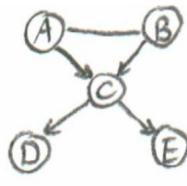
Answer: No, D and E are connected (via a path through C), so they are not required to be marginally independent.

6. Are D and E conditionally independent, given A and B?

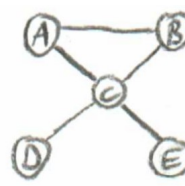
Draw ancestral graph



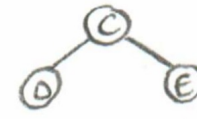
Moralize



Disorient



Delete givens



Answer: No, D and E are connected (via a path through C), so they are not required to be conditionally independent given A and B.

7. $P(D|CEG) =? P(D|C)$

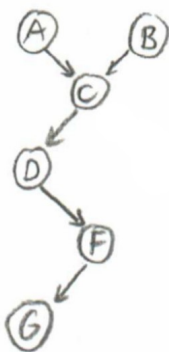
Rewrite as independence questions "Are X and Y conditionally independent, given {givens}?"

- Are D and E conditionally independent, given C? AND
- Are D and G conditionally independent, given C?

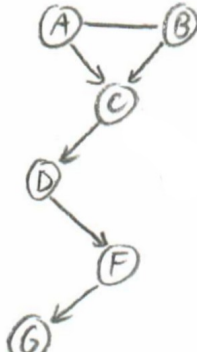
(a) Are D and E conditionally independent, given C? Yes; see example 4.

(b) Are D and G conditionally independent, given C? No, because they are connected (via F):

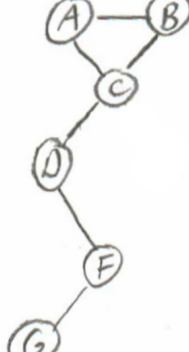
Draw ancestral graph



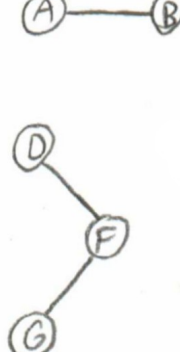
Moralize



Disorient



Delete givens



Overall answer: No. D and E are conditionally independent given C, but D and G are not required to be. Therefore we cannot assume that $P(D|CEG) = P(D|C)$.