SI 151
The solution of quiz 5

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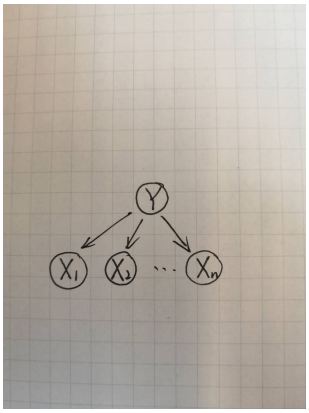
1. What is the Bayes Network of the diagonal LDA?

   Solution:
   According to the slide of lecture 6, we have

$$\begin{aligned} P(Y|X) &\propto P(X,Y) \\ &= P(X|Y) \cdot P(Y) \\ &= P(Y) \cdot \prod_i P(X_i|Y) \end{aligned}$$

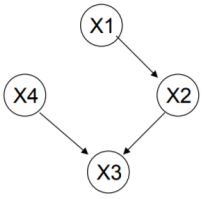
   Then the Bayes Network of diagonal LDA is given as



2. Use the D-separation to analyze the following cases:

   (a) X_1 and X_4 are conditionally independent given $\{X_2, X_3\}$.

   (b) X_1 and X_4 are not conditionally independent given X_3.



   Solution:

   (a) From X_2 to X_4, it's the head to head situation. Then X_2 and X_4 are not conditionally independent given X_3. But given X_2, the path from X_3 to X_1 is blocked according to the head to tail situation. Therefore, the statement (a) is true.

   (b) It is similar to the analysis of statement (a). The path from X_4 to X_2 is open given X_3 according to the head to head situation. Further, it is also unblocked from X_3 to X_1. Therefore, X_1 and X_4 are not conditionally independent given X_3.