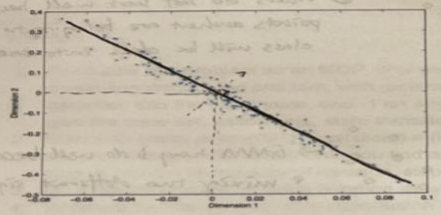
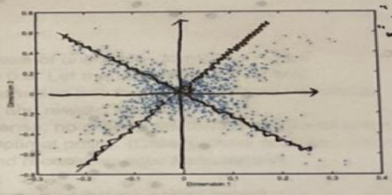
probability of observing A is 50% while that of observing B and C is 25% each. Design an appropriate encoding for this language. What is the entropy of this signal in bits?

2. Show that the K-means procedure can be viewed as a special case of the EM algorithm applied to an appropriate mixture of Gaussian densities model.

3. Plot the direction of the first and second PCA components in the figures given.





"→" answer!
"—" line delete.

4. Which clustering method(s) is most likely to produce the following results at k = 2? Choose the most likely method(s) and briefly explain why it/they will work better where others will not in at most 3 sentences.
Here are the five clustering methods you can choose from:
- Hierarchical clustering with single link
- Hierarchical clustering with complete link
- Hierarchical clustering with average link
- K-means
- EM

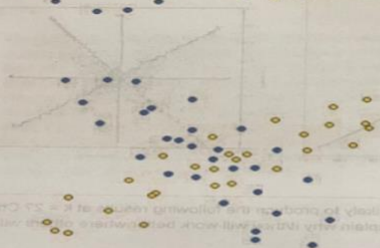
a.

→ * Hierarchical clustering with single link
* GMM may do well but it really depends on how initialization
* Others do not work because its shape. there are at least some points from different clusters have shorter distance than it supposed to be.

b.

→ K means and GMM may do well because the shape is "circle"
⊗ others do not work well because the points are/are belonging to different class will be close into one cluster.

c.



→ GMM may do well because it's mixing two different signals together
⊗ other methods may be confused by some points.

Total exploration: $Q(s, a_1) = 2.5$
$Q(s, a_2) = 2.25$

Greedy exploration: $Q(s, a_1) = 2.5$
$Q(s, a_2) = 3$

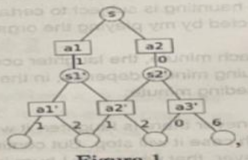


Figure 1.

6. Use the Bellman equation to calculate Q(s, a1) and Q(s, a2) for the scenario shown in the figure. Consider two different policies:
- Total exploration: All actions are chosen with equal probability.
- Greedy exploitation: The agent always chooses the best action.

Note that the rewards/next states are stochastic for the actions a1', a2' and a3'. Assume that the probabilities for the outcome of these actions are all equal. Assume that reward gathering / decision making stops at the empty circles at the bottom.

7. Consider the following simple grid-world problem. (Actions are N, S, E, W and are deterministic.) Our goal is to maximize the following reward: