

## MACHINE LEARNING

**Q1 to Q12 have only one correct answer. Choose the correct option to answer your question.**

1. Which of the following is an application of clustering?

- a) Biological network analysis
- b) Market trend prediction
- c) Topic modeling
- d) All of the above

**Answer – d) All of the above**

2. On which data type, we cannot perform cluster analysis?

- a) Time series data
- b) Text data
- c) Multimedia data
- d) None

**Answer – d) None**

3. Netflix's movie recommendation system uses-

- a) Supervised learning
- b) Unsupervised learning
- c) Reinforcement learning and Unsupervised learning
- d) All of the above

**Answer – c) Reinforcement learning and Unsupervised learning**

4. The final output of Hierarchical clustering is-

- a) The number of cluster centroids

- b) The tree representing how close the data points are to each other
- c) A map defining the similar data points into individual groups
- d) All of the above

**Answer – b) The tree representing how close the data points are to each other**

5. Which of the step is not required for K-means clustering?

- a) A distance metric
- b) Initial number of clusters
- c) Initial guess as to cluster centroids
- d) None

**Answer – d) None**

6. Which of the following is wrong?

- a) k-means clustering is a vector quantization method
- b) k-means clustering tries to group n observations into k clusters
- c) k-nearest neighbour is same as k-means
- d) None

**Answer – c) k-nearest neighbour is same as k-means**

7. Which of the following metrics, do we have for finding dissimilarity between two clusters in hierarchical clustering?

- i. Single-link
- ii. Complete-link
- iii. Average-link

Options:

- a) 1 and 2
- b) 1 and 3
- c) 2 and 3
- d) 1, 2 and 3

**Answer – d) 1, 2 and 3**

8. Which of the following are true?

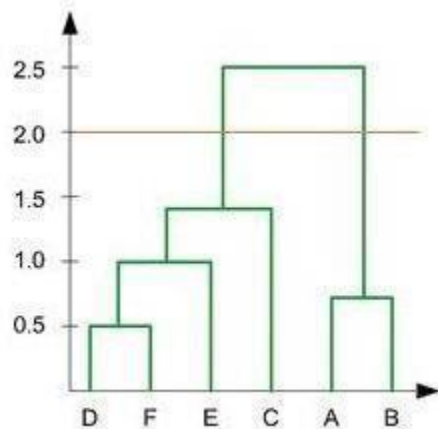
- i. Clustering analysis is negatively affected by multicollinearity of features
- ii. Clustering analysis is negatively affected by heteroscedasticity

Options:

- a) 1 only
- b) 2 only
- c) 1 and 2
- d) None of them

**Answer – a) 1 only**

9. In the figure above, if you draw a horizontal line on y-axis for  $y=2$ . What will be the number of clusters formed?



- a) 2
- b) 4
- c) 3
- d) 5

**Answer – a) 2**

10. For which of the following tasks might clustering be a suitable approach?

- a) Given sales data from a large number of products in a supermarket, estimate future sales for each of these products.

## ASSIGNMENT – 3

- b) Given a database of information about your users, automatically group them into different market segments.
- c) Predicting whether stock price of a company will increase tomorrow.
- d) Given historical weather records, predict if tomorrow's weather will be sunny or rainy.

**Answer – b) Given a database of information about your users, automatically group them into different market segments.**

11. Given, six points with the following attributes:

point	x coordinate	y coordinate
p1	0.4005	0.5306
p2	0.2148	0.3854
p3	0.3457	0.3156
p4	0.2652	0.1875
p5	0.0789	0.4139
p6	0.4548	0.3022

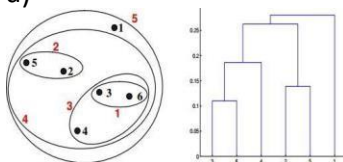
**Table :** X-Y coordinates of six points.

	p1	p2	p3	p4	p5	p6
p1	0.0000	0.2357	0.2218	0.3688	0.3421	0.2347
p2	0.2357	0.0000	0.1483	0.2042	0.1388	0.2540
p3	0.2218	0.1483	0.0000	0.1513	0.2843	0.1100
p4	0.3688	0.2042	0.1513	0.0000	0.2932	0.2216
p5	0.3421	0.1388	0.2843	0.2932	0.0000	0.3921
p6	0.2347	0.2540	0.1100	0.2216	0.3921	0.0000

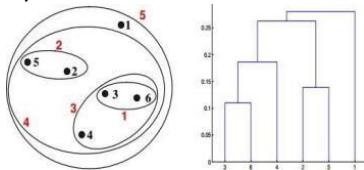
**Table :** Distance Matrix for Six Points

Which of the following clustering representations and dendrogram depicts the use of MIN or Single link proximity function in hierarchical clustering:

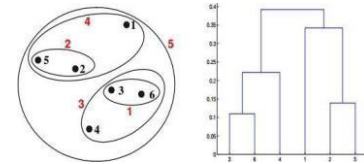
a)



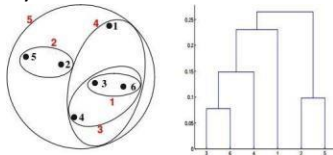
b)



c)



d)



**Answer – a)**

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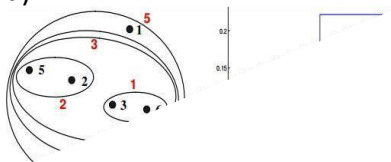
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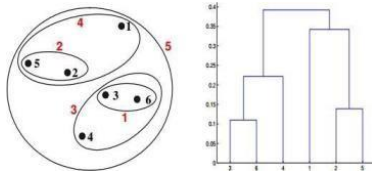
Table : Distance Matrix for Six Points

Which of the following clustering representations and dendrogram depicts the use of MAX or Complete link proximity function in hierarchical clustering?

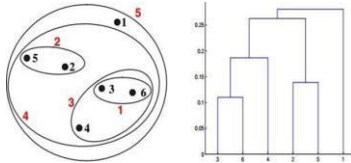
a)



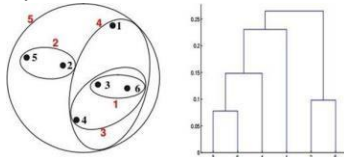
b)



c)



d)



**Answer - b)**

**Q13 to Q14 are subjective answers type questions, Answers them in their own words briefly**

13. What is the importance of clustering?

**Answer** – Clustering is useful for exploring data. If there are many cases and no obvious groupings, clustering algorithms can be used to find natural groupings. It can also serve as a useful data pre-processing step to identify homogeneous groups on which to build supervised models.

The most frequent case is for explorative analysis, when it is unknown that if the analyzed data are characterized by a small number of representative patterns that can be used to summary the dataset in a more compact representation (groups, partitions, centroids, etc.)

Another case is to evaluate the presence of outliers. IF it is sure that the data should show a certain set of patterns (similarity-based groups etc.), one can check if some data samples are not following those patterns, and analyses them individually to understand why.

Clustering **helps in understanding the natural grouping in a dataset**. Their purpose is to make sense to partition the data into some group of logical groupings.

14. How can I improve my clustering performance?

**Answer** - Improving clustering performance using independent component analysis and unsupervised feature learning. Principal Component Analysis (PCA) is an important approach to unsupervised dimensionality reduction technique. The central idea of PCA is to reduce the dimensionality of the data set consisting of a large number of variables. It is a statistical technique for determining key variables in a high dimensional data set that explain the differences in the observations and can be used to simplify the analysis and visualization of high dimensional data set.

K-means clustering algorithm can be significantly improved by **using a better initialization technique, and by repeating (re-starting) the algorithm**. When the data has overlapping clusters, k-means can improve the results of the initialization technique.

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When,

- i. the data has overlapping clusters, k-means can improve the results of the initialization technique.
- ii. the data has well separated clusters, the performance of k-means depends completely on the goodness of the initialization.

Initialization using simple furthest point heuristic (Maximin) reduces the clustering error of k-means from 15% to 6%, on average.

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