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Class/Sem:	TE/V
Experiment No.:	8
Title:	Implementation of any one clustering algorithm using languages like JAVA/ Python.
Date of Performance:	
Date of Submission:	
Marks:	
Sign of Faculty:	

Aim: To Study and Implement K-Means algorithm

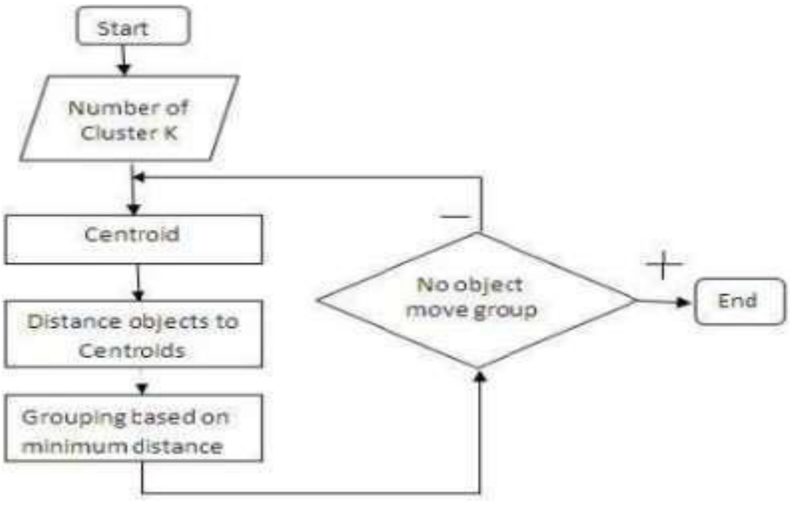
Objective:- Understand the working of K-Means algorithm and its implementation using python.

Theory:

In statistics and machine learning, k-means clustering is a method of cluster analysis which aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean.

Input
K:-number of clusters
D:- data set containing n objects
Output
A set of k clusters

Given k , the k-means algorithm is implemented in 5 steps:
Step 1: Arbitrarily choose k objects from D as the initial cluster centers.
Step 2: Find the distance from each object in the dataset with respect to cluster centers
Step 3: Assign each object to the cluster with the nearest seed point based on the mean value of the objects in the cluster.
Step 4: Update the cluster means i.e calculate the mean value of the objects for each cluster.
Step 5: Repeat the procedure, until there is no change in meaning.


Start
Number of Cluster K
Centroid
Distance objects to Centroids
Grouping based on minimum distance
No object move group
—
+
End

Example: d= {2,4,10,12,3,20,30,11,25} k =2

1. Randomly assign mean m1=3 and m2 = 4

Therefore, k1 = {2,3} Therefore, k1 = {4,10,12,20,30,11,25}

2. Randomly assign mean m1=2.5 and m2 =

16 Therefore, k1 = {2,3,4} Therefore,

k1 = {4,10,12,20,30,11,25}

3. Randomly assign mean m1=3 and m2 = 18

Therefore, k1 = {2,3,4,10} Therefore, k1 = {12,20,30,11,25}

4. Randomly assign mean m1=7 and m2 = 25

Therefore, k1 = {2,3,4,10,11,12} Therefore, k1

=

{20,30,25}

5. Randomly assign mean m1=7 and
m2 = 25 Therefore, we stop as we are
getting same mean values.

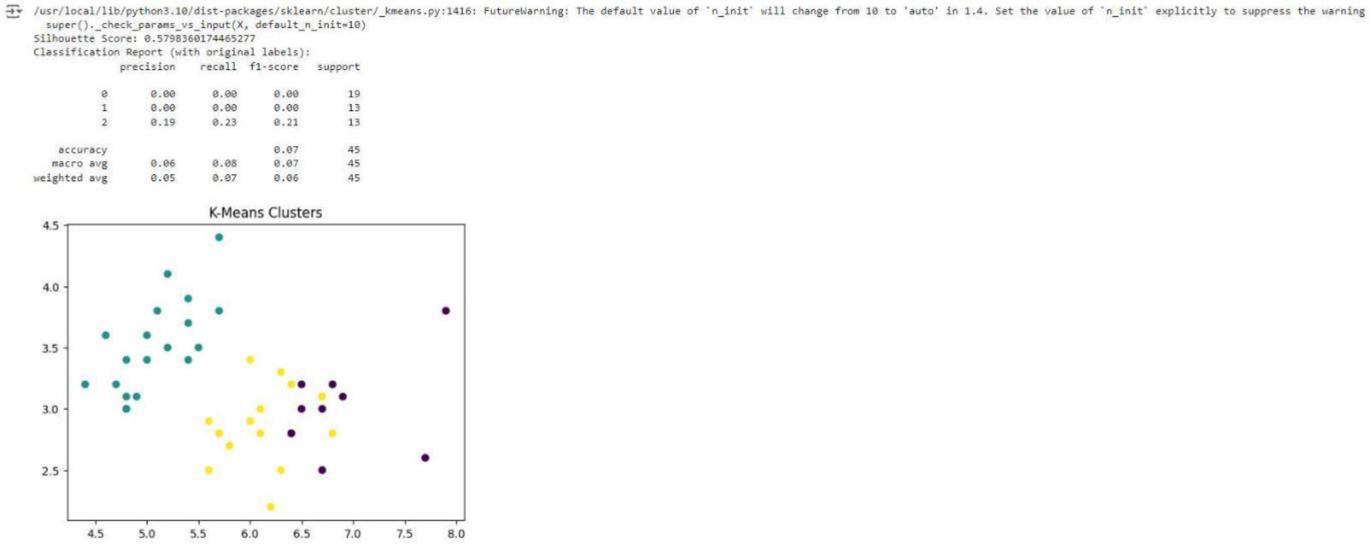
6. Therefore, Final clusters are: k1 = {2,3,4,10,11,12} Therefore, k1 = {20,30,25}

CODE:

```
import pandas as pd

import seaborn as sns

import matplotlib.pyplot as plt

from sklearn.model_selection import train_test_split

from sklearn.cluster import KMeans

from sklearn.metrics import silhouette_score, classification_report

from sklearn.datasets import load_iris

from sklearn.impute import SimpleImputer


# Load the Iris dataset (or replace it with your

dataset) iris = load_iris()

X = iris.data # Features

y = iris.target # Target labels (optional, if you're doing comparison)


# Split the data into training and test sets

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)


# Initialize and train the K-Means model

kmeans_model = KMeans(n_clusters=len(set(y)), random_state=42)
```

```
kmeans_model.fit(X_train)


# Predict the cluster labels on the test set

y_pred = kmeans_model.predict(X_test)


#Evaluate the model using Silhouette Score (common for

clustering) sil_score = silhouette_score(X_test, y_pred)

print(f'Silhouette Score: {sil_score}')


# Optionally, compare predicted clusters with true labels using a classification report

print(f'Classification Report (with original labels):\n{classification_report(y_test, y_pred)}')


#Plotting the clusters (optional, useful for visualizing 2D data)

plt.scatter(X_test[:, 0], X_test[:, 1], c=y_pred, cmap='viridis')

plt.title('K-Means Clusters')

plt.show()
```

OUTPUT:



```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:1416: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
Silhouette Score: 0.5798360174465277
Classification Report (with original labels):
              precision    recall  f1-score   support

           0       0.00      0.00      0.00        19
           1       0.00      0.00      0.00        13
           2       0.19      0.23      0.21        13

    accuracy                           0.07        45
   macro avg       0.06      0.08      0.07        45
weighted avg       0.05      0.07      0.06        45
```

CONCLUSION:

What types of data preprocessing are necessary before applying the K-Means algorithm?

Before applying the K-Means algorithm, key data preprocessing steps include:

1. Scaling: Normalize or standardize features, as K-Means is sensitive to scale.
2. Handling Missing Values: Impute or remove missing data, since K-Means does not handle them directly.
3. Outlier Treatment: Address outliers as they can distort cluster formation.
4. Dimensionality Reduction: Use PCA or similar techniques if the data has many features to improve clustering performance and reduce noise.
5. Encoding Categorical Data: Convert categorical variables to numeric using one-hot encoding or label encoding.