 Marwadi University	Marwadi University Faculty of Technology Department of Information and Communication Technology	
Subject: Introduction to R and R Studio (01CT0106)	Aim: To obtain the distinct clusters for unsupervised data using KMeans Clustering	
Experiment: 14	Date: 02/05/2023	Enrollment No: 92200133030

Aim: To obtain the distinct clusters for unsupervised data using KMeans Clustering

IDE: R Studio

Theory:

K-Means Clustering is an Unsupervised Learning algorithm, which groups the unlabeled dataset into different clusters. Here K defines the number of pre-defined clusters that need to be created in the process, as if $K=2$, there will be two clusters, and for $K=3$, there will be three clusters, and so on. It is an iterative algorithm that divides the unlabeled dataset into k different clusters in such a way that each dataset belongs only one group that has similar properties.

It allows us to cluster the data into different groups and a convenient way to discover the categories of groups in the unlabeled dataset on its own without the need for any training.

It is a centroid-based algorithm, where each cluster is associated with a centroid. The main aim of this algorithm is to minimize the sum of distances between the data point and their corresponding clusters.


The algorithm takes the unlabeled dataset as input, divides the dataset into k-number of clusters, and repeats the process until it does not find the best clusters. The value of k should be predetermined in this algorithm.

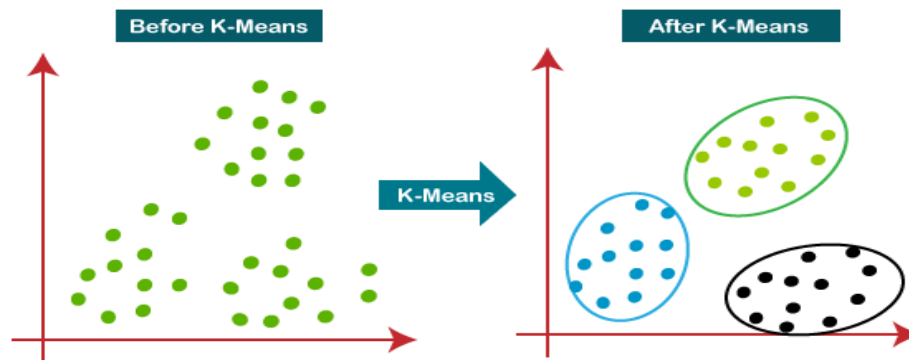
The k-means clustering algorithm mainly performs two tasks:

- Determines the best value for K center points or centroids by an iterative process.
- Assigns each data point to its closest k-center. Those data points which are near to the particular k-center, create a cluster.

Hence each cluster has datapoints with some commonalities, and it is away from other clusters.

The below diagram explains the working of the K-means Clustering Algorithm:

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How does the K-Means Algorithm Work?

The working of the K-Means algorithm is explained in the below steps:

Step-1: Select the number K to decide the number of clusters.

Step-2: Select random K points or centroids. (It can be other from the input dataset).

Step-3: Assign each data point to their closest centroid, which will form the predefined K clusters.

Step-4: Calculate the variance and place a new centroid of each cluster.

Step-5: Repeat the third steps, which means reassign each datapoint to the new closest centroid of each cluster.

Step-6: If any reassignment occurs, then go to step-4 else go to FINISH.


Step-7: The model is ready.

Program:

Write a R script to perform clustering using K-Means Clustering approach

```
library(cluster)
data <- matrix(rnorm(100), ncol = 2)
k <- 3
kmeans_result <- kmeans(data, centers = k)
cluster_assignments <- kmeans_result$cluster
cluster_centers <- kmeans_result$centers

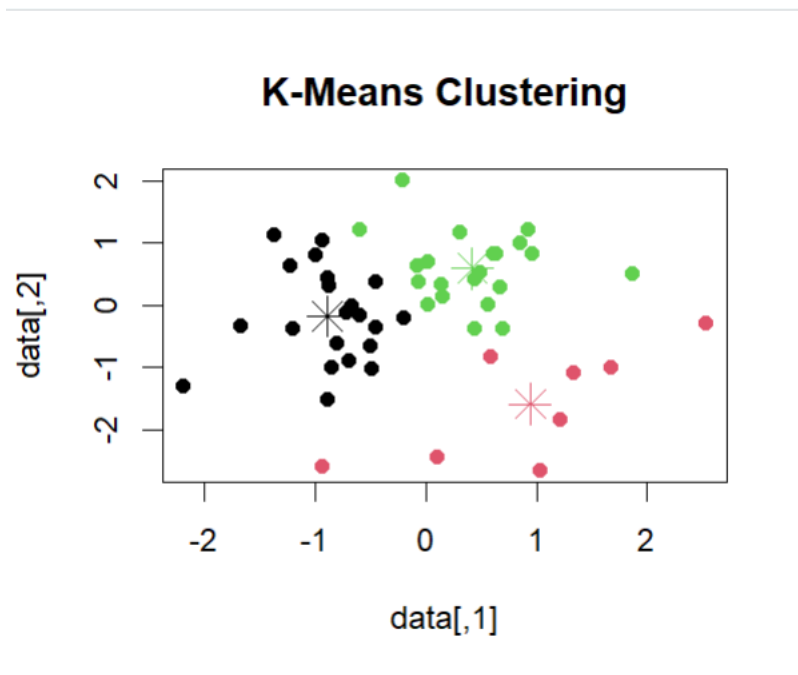
cat("Cluster Assignments:\n")
cat(cluster_assignments, "\n")
cat("\nCluster Centers:\n")
print(cluster_centers)
plot(data, col = cluster_assignments, pch = 19, main = "K-Means Clustering")
points(cluster_centers, col = 1:k, pch = 8, cex = 2)
```


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Output:

```
> data <- matrix(rnorm(100), ncol = 2)
> k <- 3
> kmeans_result <- kmeans(data, centers = k)
> cluster_assignments <- kmeans_result$cluster
> cluster_centers <- kmeans_result$centers
>
> cat("Cluster Assignments:\n")
Cluster Assignments:
> cat(cluster_assignments, "\n")
3 1 1 1 3 3 2 1 1 1 1 3 2 3 1 1 3 1 3 3 2 1 1 2 2 1 2 3 3 2 3 3 3 1 3 1 3 1 1 3 1 1 3 1 3 1 3 3 2 3
> cat("\nCluster Centers:\n")

Cluster Centers:
> print(cluster_centers)
      [,1]      [,2]
1 -0.8935350 -0.1787628
2  0.9402085 -1.5886944
3  0.4162895  0.5899657
> plot(data, col = cluster_assignments, pch = 19, main = "K-Means Clustering")
> points(cluster_centers, col = 1:k, pch = 8, cex = 2)
> |
```



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Observation and Learnings:
