ASSIGNMENT-3

21MAT212

MIS - 4

Professor-Jithin Sir

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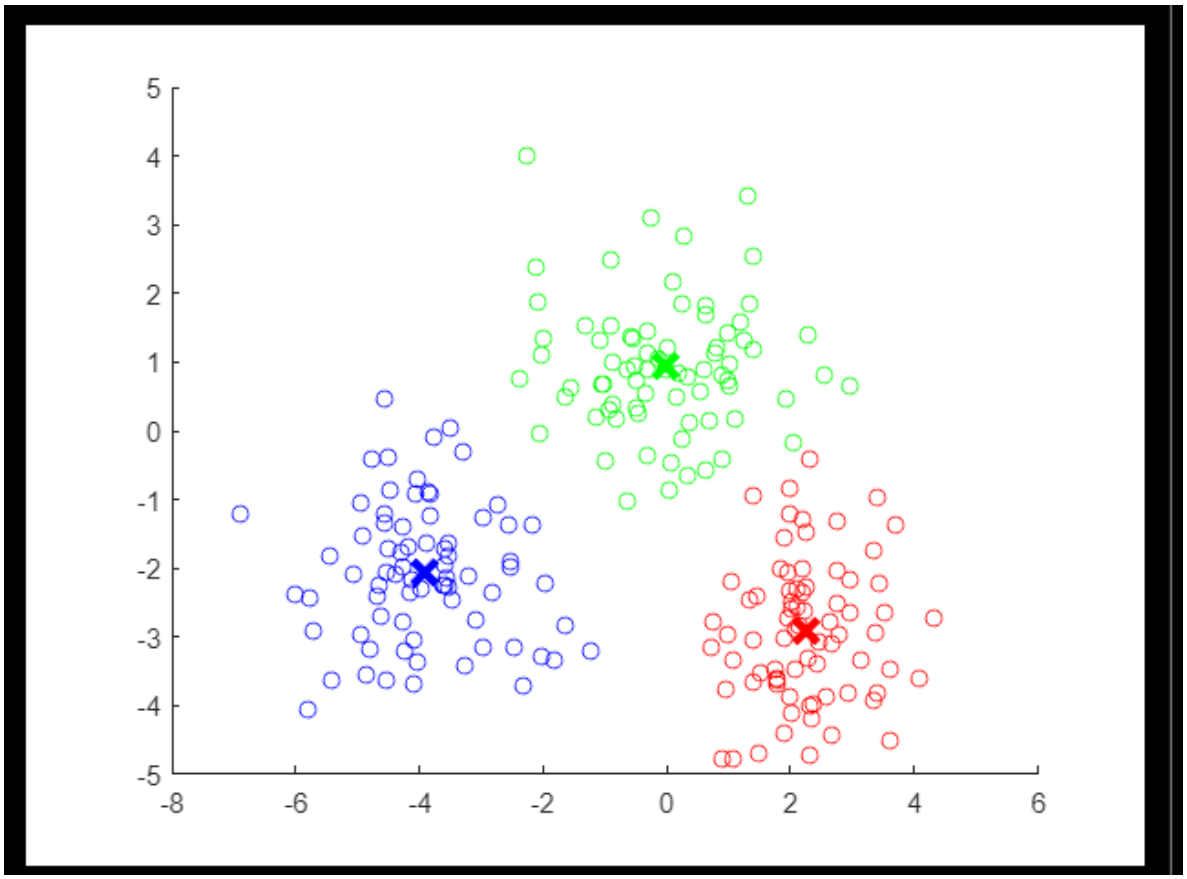
1) Create a data set containing 3 different groups of data points and develop the MATLAB code to perform K-means clustering.

Code:

```
% Define the number of data points in each group
N = 75;


% Define the centers of each group
center1 = [-4 -2];
center2 = [2 -3];
center3 = [0 1];


% Generate the data points for each group
group1 = center1 + randn(N,2);
group2 = center2 + randn(N,2);
group3 = center3 + randn(N,2);


% Concatenate the data points into a single matrix
X = [group1; group2; group3];


% Define the number of clusters (groups)
K = 3;


% Initialize the cluster centroids randomly
cent_arr = randperm(N*3,K);
centroids = X(cent_arr,:);


% Perform K-means clustering
max_iter = 50;
for iter = 1:max_iter
    % Assign each data point to the nearest centroid
    distances = zeros(N*3,K);
    for k = 1:K
        for i = 1:N*3
            distances(i,k) = norm(X(i,:) - centroids(k,:));
        end
    end
    [min_dist,labels] = min(distances,[],2);


    % Update the cluster centroids
    for k = 1:K
        centroids(k,:) = mean(X(labels==k,:),1);
    end
end
```

```
% Plot the results
colors = ['r','g','b'];
figure;
hold on;
for k = 1:K
    plot(X(labels==k,1),X(labels==k,2),[colors(k) 'o']);
    plot(centroids(k,1),centroids(k,2),[colors(k)
'x'],'MarkerSize',12,'LineWidth',3);
end
hold off;
```

Output:



2.) Download a data set from an open source and develop MATLAB code to perform the K-means clustering. Use appropriate methodology to choose the best value for K.

Code:

```
function [idx, centroids] = kmeans_using_for_loop(data, k)%function to perform
kmeans
% Randomly initialize the centroids
idx = randi(k, size(data, 1), 1);
centroids = zeros(k, size(data, 2));
% Iterate until convergence
while true
% Update the centroids
for i = 1:k
centroids(i, :) = mean(data(idx == i, :));
end
% Assign data points to the nearest centroid
prevIdx = idx;
for i = 1:size(data, 1)
distances = sum((data(i, :) - centroids).^2, 2);
[~, idx(i)] = min(distances);
end
% Check for convergence
if isequal(prevIdx, idx)
break;


end
end
end


function idealK = chooseIdealK(data, maxK)%function to get an ideal value
% of k using elbow method
% Initialize sum of squared distances array
sse = zeros(maxK, 1);
% Perform k-means clustering for different k values
for k = 1:maxK
    [idx, centroids] = kmeans_using_for_loop(data, k);
% Calculate sum of squared distances for each cluster
for i = 1:k
    sse(k) = sse(k) + clustersum(data,idx,centroids,i);
end
end


% Plot the sum of squared distances
figure;
plot(1:maxK, sse, 'o-');
xlabel('Number of Clusters (k)');
```

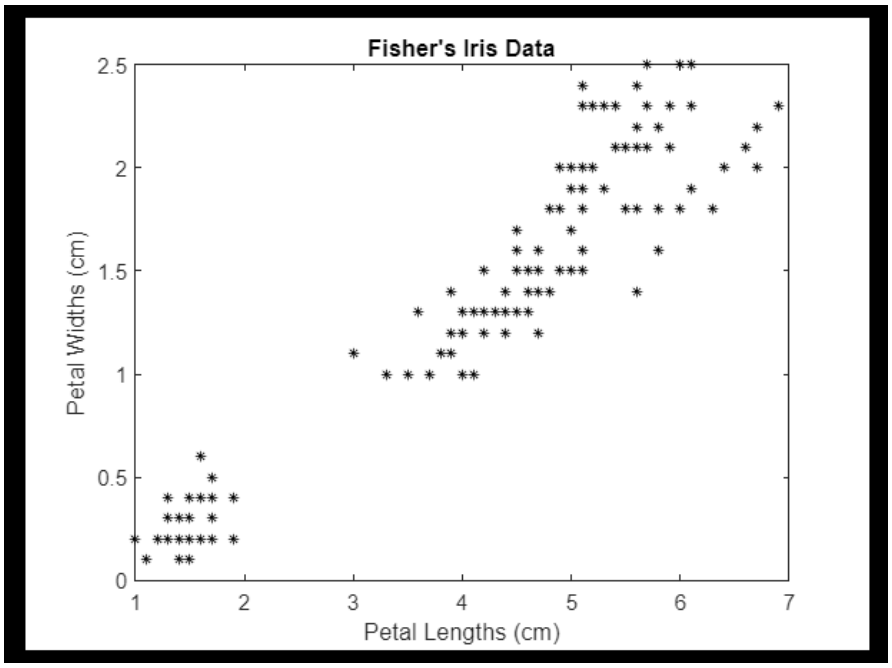
```
ylabel('Sum of Squared Distances');
title('Elbow Method');
% Taking ideal k value from the graph made by elbow point
prompt = 'Enter the ideal k value: ';
idealK = input(prompt);
end


function sum = clustersum(data,idx,centroids,k)%function to calculate
varianace
% in the clusters using
% sum of square distances
sum=0;
    for i = 1:k
        for j=1:length(data(idx == i, :))
            sum=sum+norm(data(idx == i, :)-centroids(i,:))^2;
        end
    end
end
```

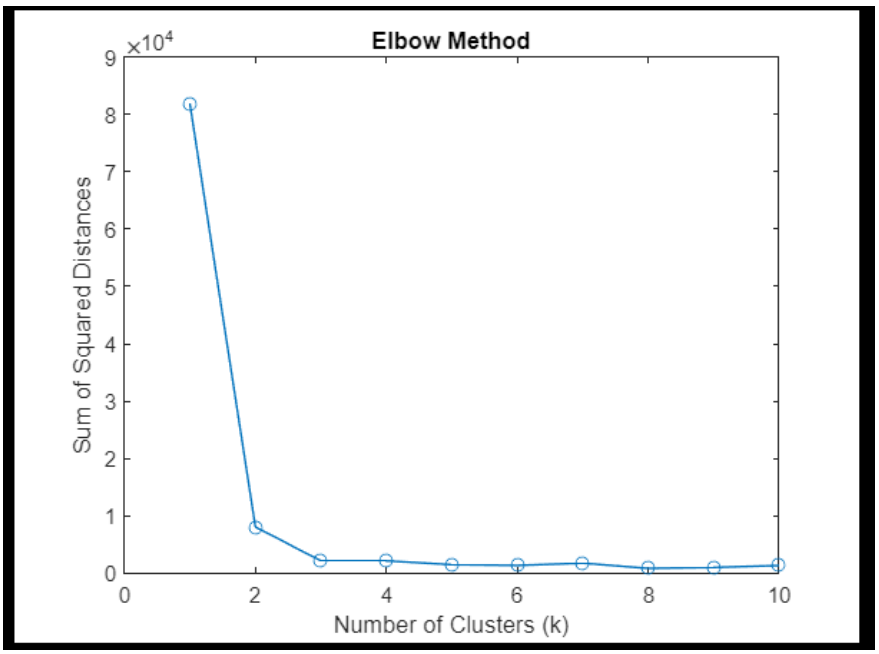
Input: Dataset

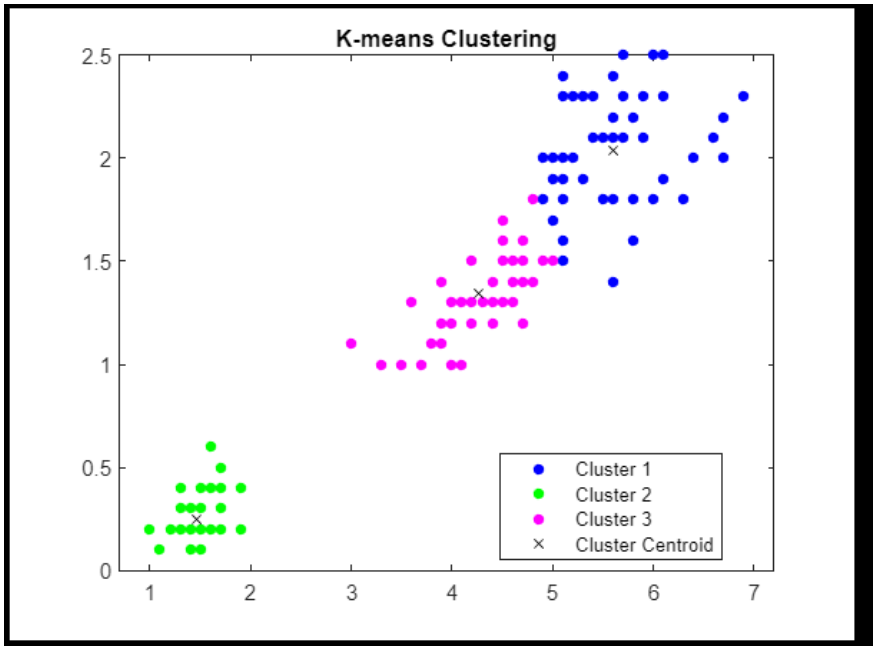
```
clc;clear all;
load fisheriris % Loading the dataset from matlab inbuilt


X = meas(:,3:4);


figure;
plot(X(:,1),X(:,2),'k*','MarkerSize',5);
title 'Fisher''s Iris Data';
xlabel 'Petal Lengths (cm)';
ylabel 'Petal Widths (cm)';


%getting the ideal value of k using elbow method
k=chooseIdealK(X,10);


%performing kmeans with the ideal k
[idx, centroids] = kmeans_using_for_loop(X, k);


% Plot the results
figure;
gscatter(X(:, 1), X(:, 2),idx,'bgmkr');
hold on;
scatter(centroids(:, 1), centroids(:, 2),'kx');
G = max(idx) ;
str = repmat("Cluster ",G,1) ;
```

```
str = strcat(str,string((1:G)')) ;
lgd = legend([str ; "Cluster Centroids"]) ;
title('K-means Clustering');
```

Output:







THANK YOU !!

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