Reg.No.: 21MIS1044

Name: Srinivasan JP

The single link clustering in the Hierarchical Clustering executed below

```
In [ ]:  # Importing the libraries
         import numpy as nm
         import matplotlib.pyplot as mtp
         import pandas as pd
```

Mall data set going to be used by both the Single cluster and Complete link cluster

```
In [ ]:  # Importing the dataset
         dataset = pd.read_csv('./mall/Mall_Customers.csv')
```

Extracting the required features

```
In [ ]:  x = dataset.iloc[:, [3, 4]].values
```

Plotting the dendrogrma

```
In [ ]:  import scipy.cluster.hierarchy as shc
         dendro = shc.dendrogram(shc.linkage(x, method="single"))
         mtp.title("Dendrogrma Plot")
         mtp.ylabel("Euclidean Distances")
         mtp.xlabel("Customers")
         mtp.show()
```

Dendrogrma Plot
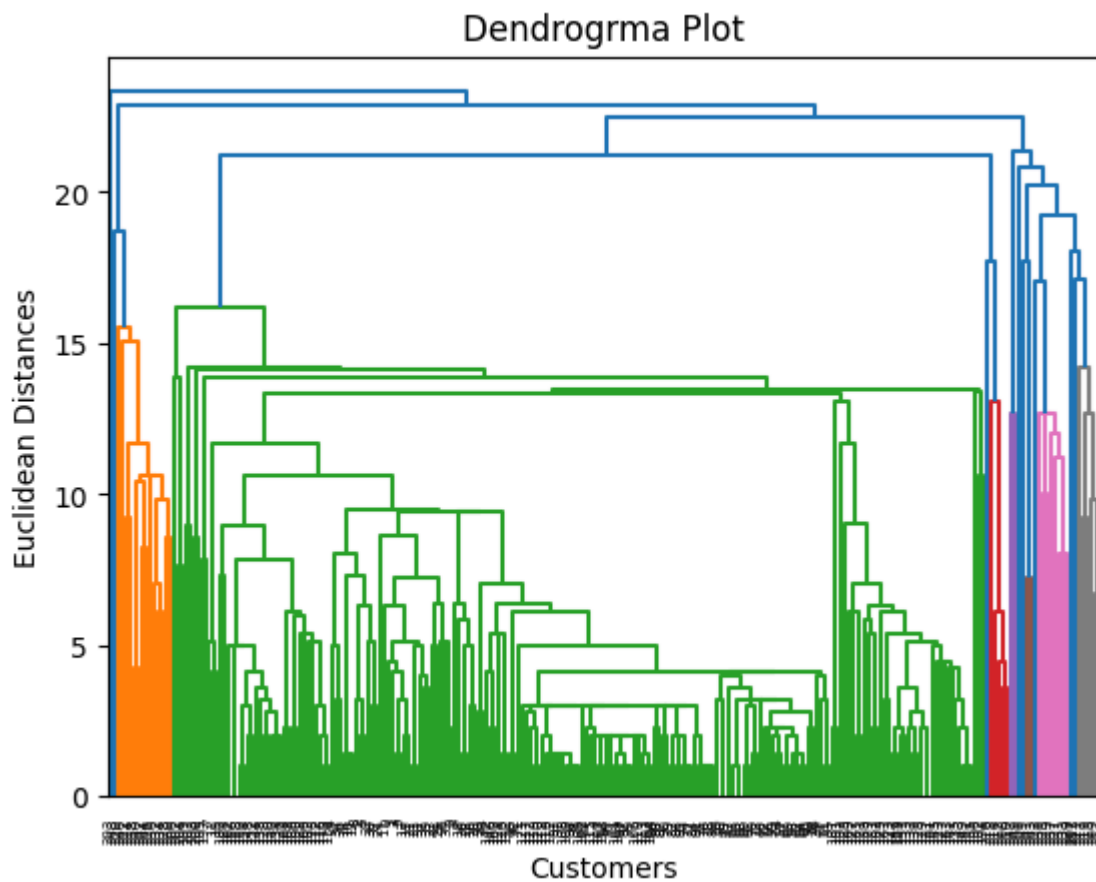
single link modle defining with the 5 clusters

```
In [ ]:  #training the hierarchical model on dataset
         from sklearn.cluster import AgglomerativeClustering
         hc= AgglomerativeClustering(n_clusters=5, linkage='single')
```
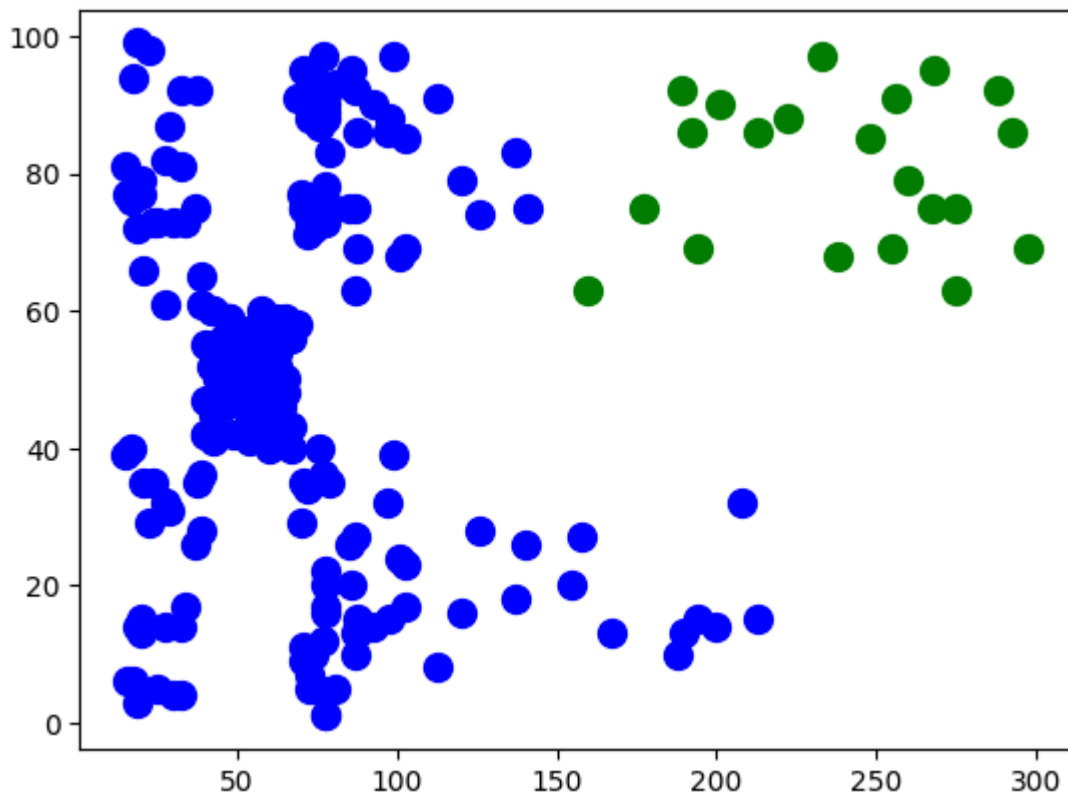
model fitting to the dataset
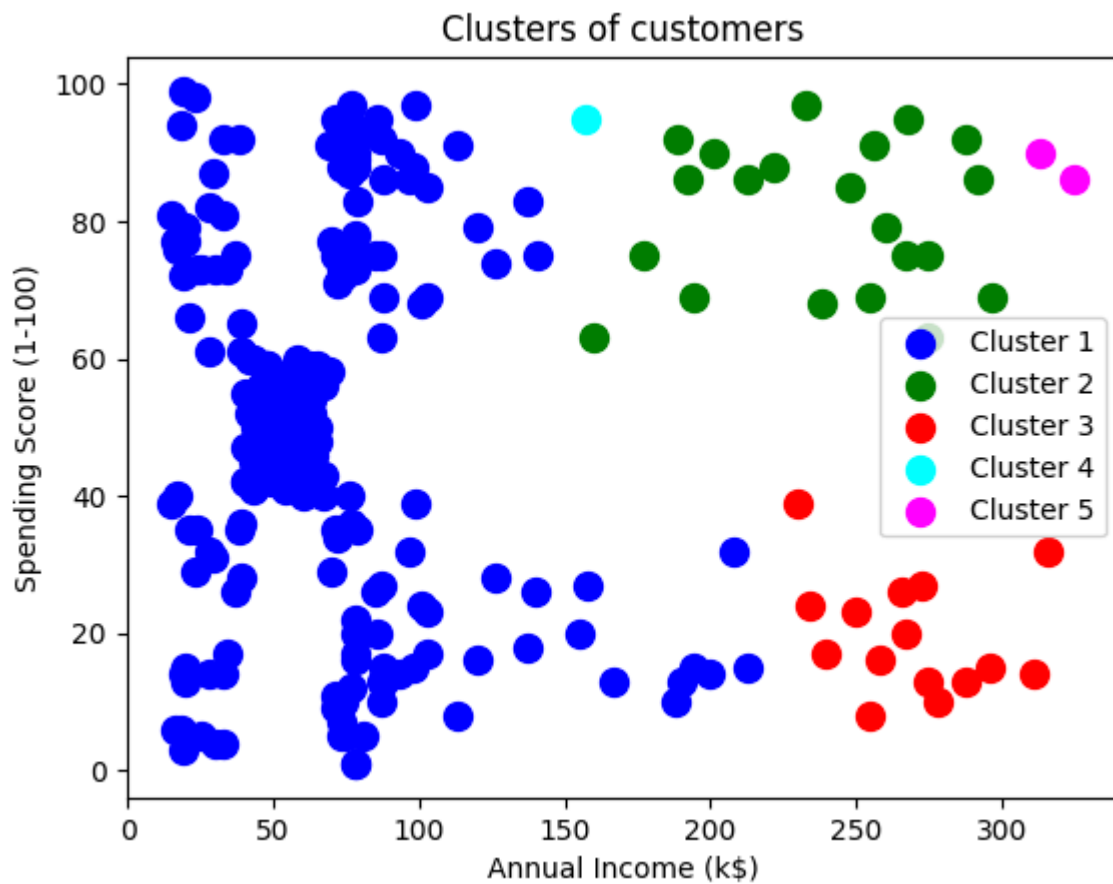
```
In [ ]:  y_pred= hc.fit_predict(x)
```

Plotting the predicted data

```
In [ ]:  mtp.scatter(x[y_pred == 0, 0], x[y_pred == 0, 1], s = 100, c = 'blue', label = 'Cluste
         mtp.scatter(x[y_pred == 1, 0], x[y_pred == 1, 1], s = 100, c = 'green', label = 'Clust
```

```
Out[ ]:  <matplotlib.collections.PathCollection at 0x2420e61e390>
```
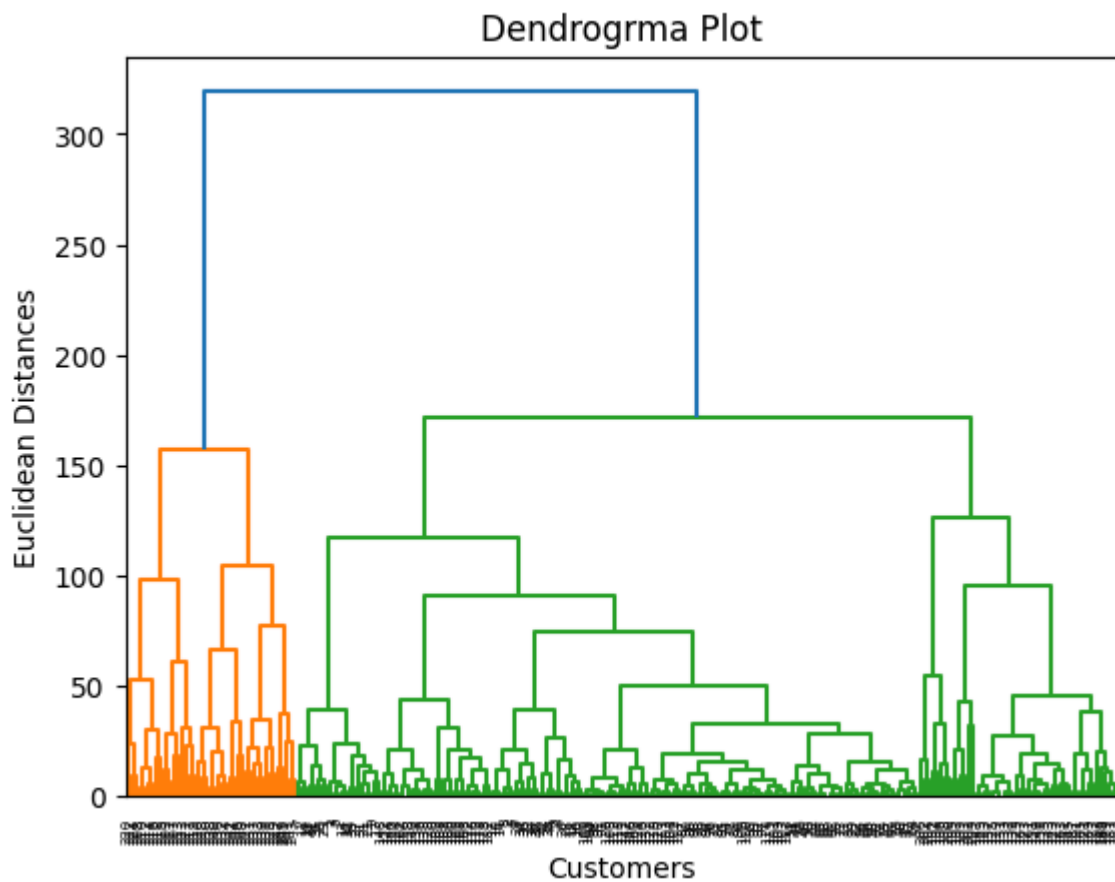
```
In [ ]:  mtp.scatter(x[y_pred == 0, 0], x[y_pred == 0, 1], s = 100, c = 'blue', label = 'Cluste
         mtp.scatter(x[y_pred == 1, 0], x[y_pred == 1, 1], s = 100, c = 'green', label = 'Clust
         mtp.scatter(x[y_pred== 2, 0], x[y_pred == 2, 1], s = 100, c = 'red', label = 'Cluster
         mtp.scatter(x[y_pred == 3, 0], x[y_pred == 3, 1], s = 100, c = 'cyan', label = 'Cluste
         mtp.scatter(x[y_pred == 4, 0], x[y_pred == 4, 1], s = 100, c = 'magenta', label = 'Clu
         mtp.title('Clusters of customers')
         mtp.xlabel('Annual Income (k$)')
         mtp.ylabel('Spending Score (1-100)')
         mtp.legend()
         mtp.show()
```

Clusters of customers

Complete link clustering

using the same data set with is defined for single link cluser

```
In [ ]:  import scipy.cluster.hierarchy as shc
         dendro = shc.dendrogram(shc.linkage(x, method="complete"))
         mtp.title("Dendrogrma Plot")
         mtp.ylabel("Euclidean Distances")
         mtp.xlabel("Customers")
         mtp.show()
```

Dendrogrma Plot

Defining the complete link cluster

```
In [ ]:  #training the hierarchical model on dataset
         from sklearn.cluster import AgglomerativeClustering
         hc= AgglomerativeClustering(n_clusters=5, linkage='complete')
```

fitting with the cluster

```
In [ ]:  y_pred= hc.fit_predict(x)
```

```
In [ ]:  mtp.scatter(x[y_pred == 0, 0], x[y_pred == 0, 1], s = 100, c = 'blue', label = 'Cluste
         mtp.scatter(x[y_pred == 1, 0], x[y_pred == 1, 1], s = 100, c = 'green', label = 'Clust
```

```
Out[ ]:  <matplotlib.collections.PathCollection at 0x24211cdb470>
```
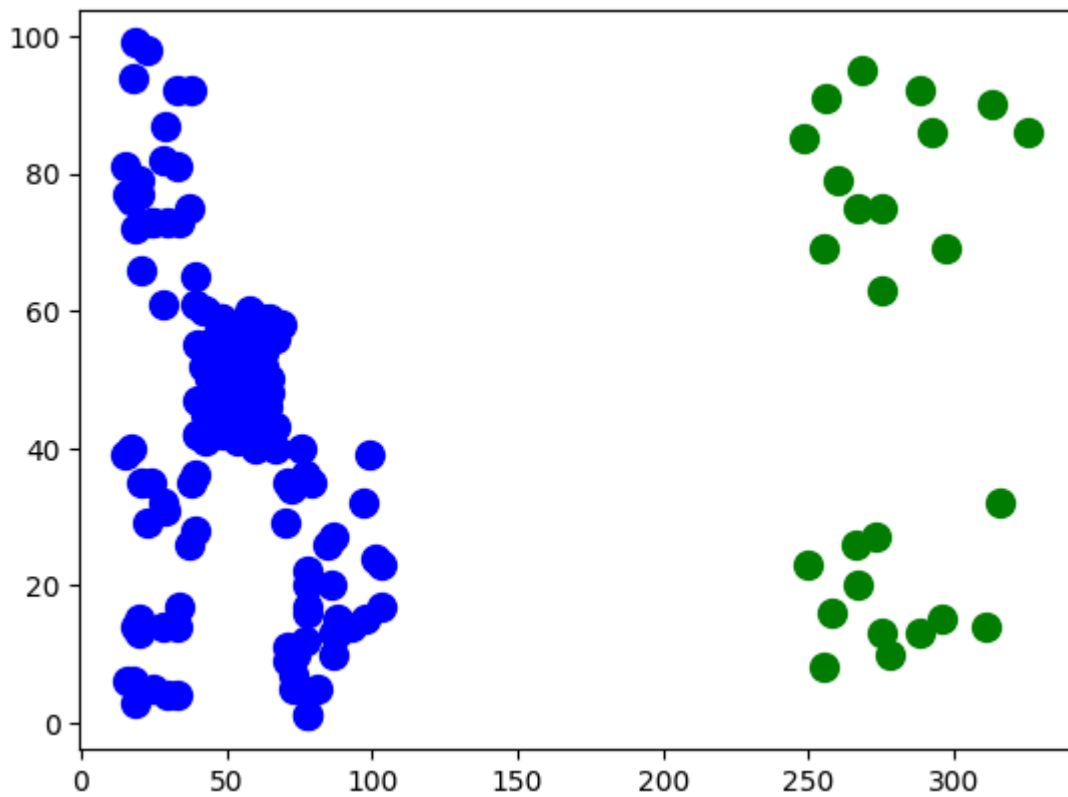
Plotting the result of the predition

```
In [ ]: mtp.scatter(x[y_pred == 0, 0], x[y_pred == 0, 1], s = 100, c = 'blue', label = 'Cluste
        mtp.scatter(x[y_pred == 1, 0], x[y_pred == 1, 1], s = 100, c = 'green', label = 'Clust
        mtp.scatter(x[y_pred== 2, 0], x[y_pred == 2, 1], s = 100, c = 'red', label = 'Cluster
        mtp.scatter(x[y_pred == 3, 0], x[y_pred == 3, 1], s = 100, c = 'cyan', label = 'Cluste
        mtp.scatter(x[y_pred == 4, 0], x[y_pred == 4, 1], s = 100, c = 'magenta', label = 'Clu
        mtp.title('Clusters of customers')
        mtp.xlabel('Annual Income (k$)')
        mtp.ylabel('Spending Score (1-100)')
        mtp.legend()
        mtp.show()
```

Clusters of customers