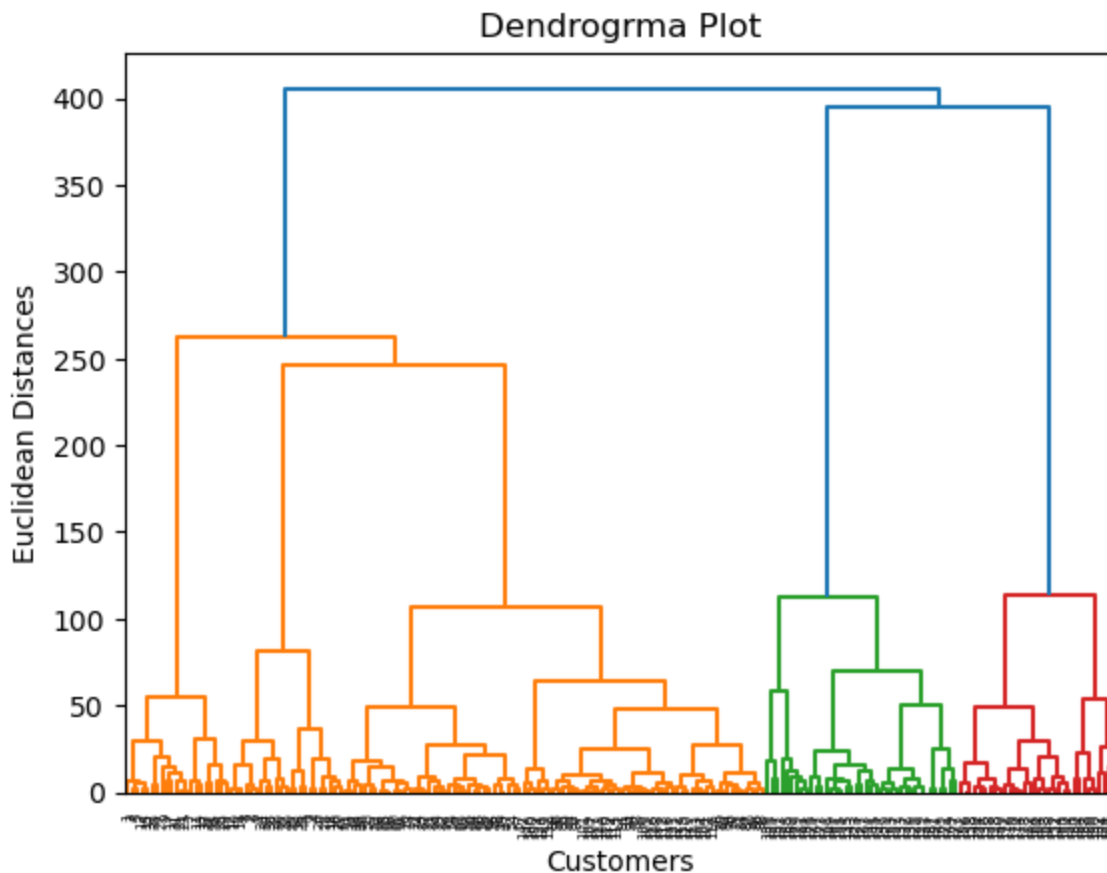


```
In [15]: # Importing the libraries
import numpy as nm
import matplotlib.pyplot as mtp
import pandas as pd
```

```
In [16]: # Importing the dataset
dataset = pd.read_csv('Mall_Customers.csv')
```

```
In [17]: x = dataset.iloc[:, [3, 4]].values
```

```
In [18]: #Finding the optimal number of clusters using the dendrogram
import scipy.cluster.hierarchy as shc
dendro = shc.dendrogram(shc.linkage(x, method="ward"))
mtp.title("Dendrogrma Plot")
mtp.ylabel("Euclidean Distances")
mtp.xlabel("Customers")
mtp.show()
```

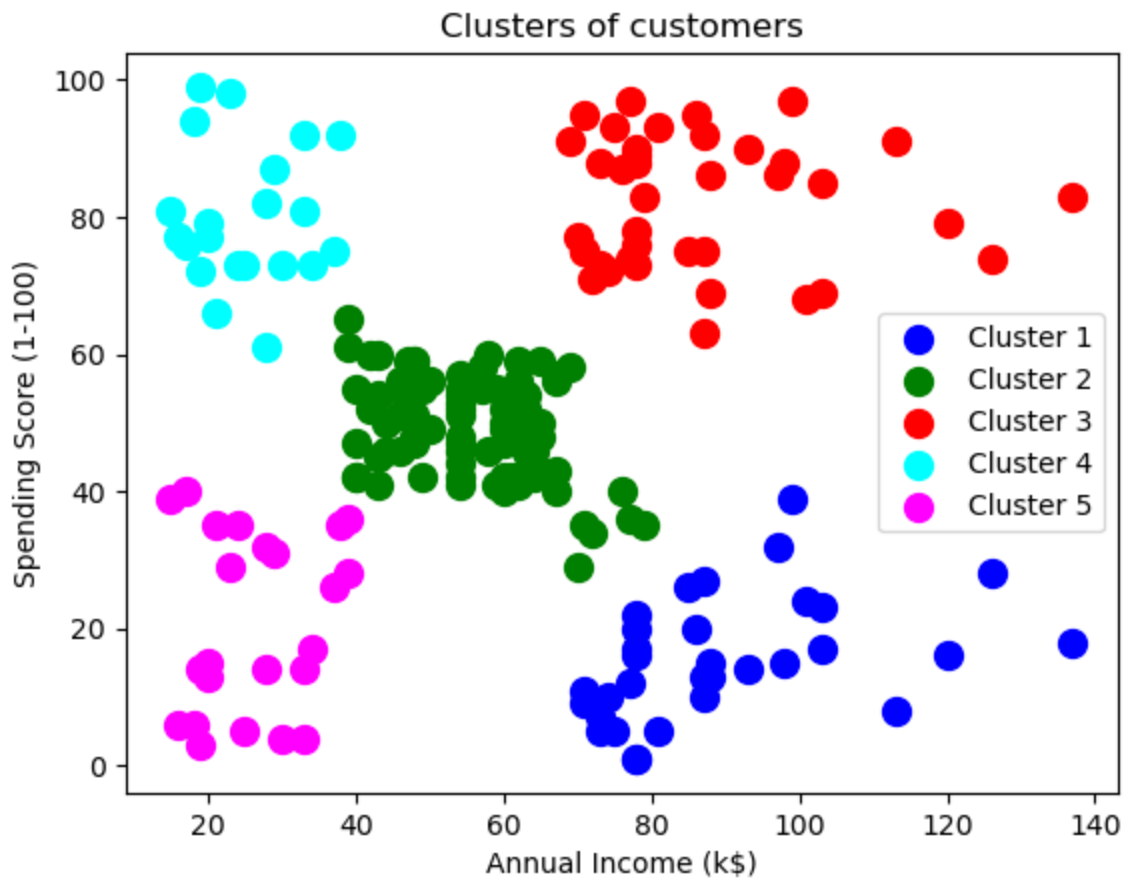


```
In [19]: #training the hierarchical model on dataset
from sklearn.cluster import AgglomerativeClustering
hc= AgglomerativeClustering(n_clusters=5, affinity='euclidean', linkage='ward')
y_pred= hc.fit_predict(x)
```

C:\Users\LENOVO\anaconda3\Lib\site-packages\sklearn\cluster_agglomerative.py:1005: FutureWarning: Attribute `affinity` was deprecated in version 1.2 and will be removed in 1.4. Use `metric` instead
warnings.warn(

```
In [20]: #visulaizing the clusters
mtp.scatter(x[y_pred == 0, 0], x[y_pred == 0, 1], s = 100, c = 'blue', label = 'Cluster 1')
mtp.scatter(x[y_pred == 1, 0], x[y_pred == 1, 1], s = 100, c = 'green', label = 'Cluster 2')
mtp.scatter(x[y_pred == 2, 0], x[y_pred == 2, 1], s = 100, c = 'red', label = 'Cluster 3')
mtp.scatter(x[y_pred == 3, 0], x[y_pred == 3, 1], s = 100, c = 'cyan', label = 'Cluster 4')
```

```
mtp.scatter(x[y_pred == 4, 0], x[y_pred == 4, 1], s = 100, c = 'magenta', label = 'Clust  
mtp.title('Clusters of customers')  
mtp.xlabel('Annual Income (k$)')  
mtp.ylabel('Spending Score (1-100)')  
mtp.legend()  
mtp.show()
```



In []: