```
In [9]: #importing the libraries
         import numpy as nm
         import matplotlib.pyplot as mtp
         import pandas as pd

         #importing the dataset
         dataset=pd.read_csv('hierarchical data.csv')
         x=dataset.iloc[:,[3,4]].values

         #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("Dendrogram plot")
         mtp.ylabel("Euclidean Distance")
         mtp.xlabel("Customers")
         mtp.show()
```
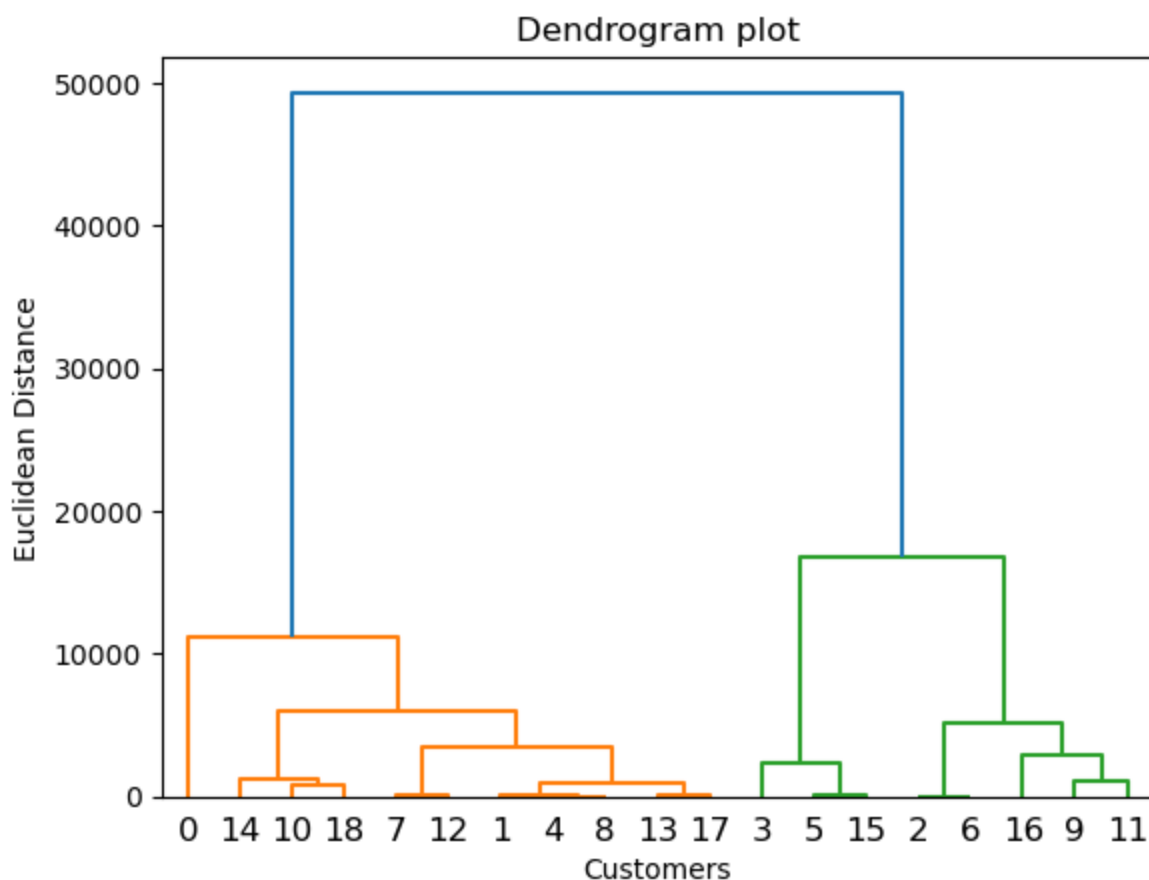


```
In [13]:  #training the hierarchical model on dataset
          from sklearn.cluster import AgglomerativeClustering
          hc=AgglomerativeClustering(n_clusters=5,affinity='euclidean',linkage='ward')
          y_pred=hc.fit_predict(x)
```

```
C:\Users\R.MUNIRANJANI\anaconda3\Lib\site-packages\sklearn\cluster\_agglomerative.py:100
5: FutureWarning: Attribute `affinity` was deprecated in version 1.2 and will be removed
in 1.4. Use `metric` instead
  warnings.warn(
```
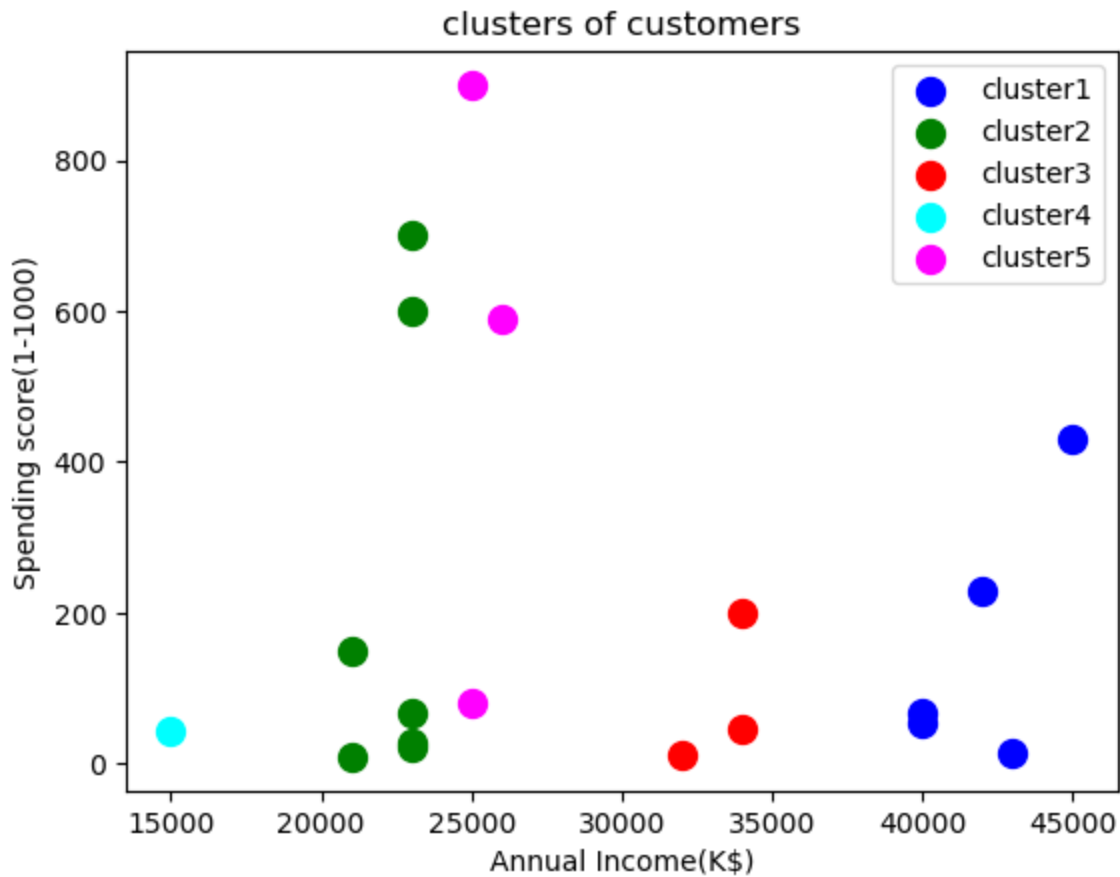
visulizing the clusters

```
In [15]:  mtp.scatter(x[y_pred==0,0],x[y_pred==0,1],s=100,c='blue',label='cluster1')
          mtp.scatter(x[y_pred==1,0],x[y_pred==1,1],s=100,c='green',label='cluster2')
          mtp.scatter(x[y_pred==2,0],x[y_pred==2,1],s=100,c='red',label='cluster3')
```

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```
mtp.scatter(x[y_pred==3,0],x[y_pred==3,1],s=100,c='cyan',label='cluster4')
mtp.scatter(x[y_pred==4,0],x[y_pred==4,1],s=100,c='magenta',label='cluster5')
mtp.title('clusters of customers')
mtp.xlabel('Annual Income(K$)')
mtp.ylabel('Spending score(1-1000)')
mtp.legend()
mtp.show()
```


clusters of customers

In [ ]: