# K-Means Clustering

## Importing the libraries

In [ ]:

```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

## Importing the dataset

In [ ]:

```
dataset = pd.read_csv('Mall_Customers.csv')
dataset.head()
```

Out[2]:

| | CustomerID | Genre | Age | Annual Income (k$) | Spending Score (1-100) |
|---|---|---|---|---|---|
| **0** | 1 | Male | 19 | 15 | 39 |
| **1** | 2 | Male | 21 | 15 | 81 |
| **2** | 3 | Female | 20 | 16 | 6 |
| **3** | 4 | Female | 23 | 16 | 77 |
| **4** | 5 | Female | 31 | 17 | 40 |

In [ ]:

```
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype 
---  ------                  --------------  ----- 
 0   CustomerID              200 non-null    int64 
 1   Genre                   200 non-null    object
 2   Age                     200 non-null    int64 
 3   Annual Income (k$)      200 non-null    int64 
 4   Spending Score (1-100)  200 non-null    int64 
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

In [ ]:

```
dataset.shape
```

Out[3]:

```
(200, 5)
```

In [ ]:

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

In [ ]:

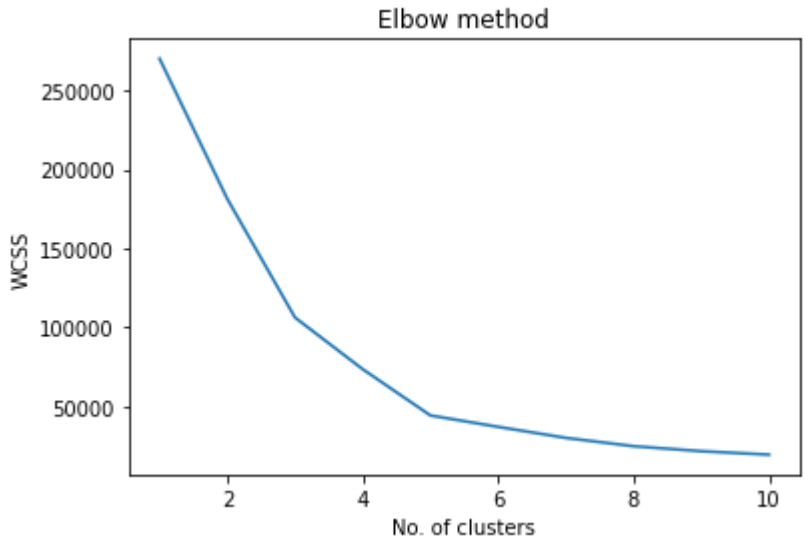
```
print(X[0:5,:])
```

```
[[15 39]
 [15 81]
 [16  6]
 [16 77]
 [17 40]]
```

## Using the elbow method to find the optimal number of clusters

In [ ]:

```
from sklearn.cluster import KMeans
wcss = []
for i in range(1,11):
  kmeans = KMeans(n_clusters= i, init='k-means++',random_state= 42)
  kmeans.fit(X)
  wcss.append(kmeans.inertia_)
plt.plot(range(1,11),wcss)
plt.title("Elbow method")
plt.xlabel("No. of clusters")
plt.ylabel("WCSS")
plt.show()
```

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# Training the K-Means model on the dataset

In [ ]:

```
kmeans = KMeans(n_clusters= 5, init='k-means++',random_state= 42)
kmeans.fit(X)
```

Out[8]:

```
KMeans(n_clusters=5, random_state=42)
```

# Statistics from the initialization run with the lowest SSE are available as attributes of kmeans after calling .fit()

In [ ]:

```
# The lowest SSE value
kmeans.inertia_
```

Out[24]:

```
44448.45544793371
```

In [ ]:

```
# Final locations of the centroid
kmeans.cluster_centers_
```

Out[25]:

```
array([[25.72727273, 79.36363636],
       [55.2962963 , 49.51851852],
       [86.53846154, 82.12820513],
       [26.30434783, 20.91304348],
       [88.2       , 17.11428571]])
```

In [ ]:

```
# The number of iterations required to converge
kmeans.n_iter_
```

Out[26]:

```
4
```

In [ ]:

```
#Finally, the cluster assignments are stored as a one-dimensional NumPy array in kmeans.
kmeans.labels_
```

Out[27]:

```
array([3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0,
       3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 0, 3, 1,
       3, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 4, 2, 1, 2, 4, 2, 4, 2,
       1, 2, 4, 2, 4, 2, 4, 2, 4, 2, 1, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2,
       4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2,
       4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2, 4, 2,
       4, 2], dtype=int32)
```

# Creating Output labels for Generating Graph

In [ ]:

```
y_kmeans = kmeans.fit_predict(X)
```

In [ ]:

```
print(y_kmeans)
```

```
[2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2
 3 2 3 2 3 2 0 2 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 4 1 4 0 4 1 4 1 4 0 4 1 4 1 4 1 4 1 4 0 4 1 4 1 4
 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1
 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4]
```

In [ ]:

```
from sklearn.metrics import accuracy_score
print(accuracy_score(kmeans.labels_,y_kmeans))
```

```
1.0
```

# Visualising the clusters

In [ ]:

```
plt.scatter(X[y_kmeans == 0,0],X[y_kmeans == 0,1],s=100, c = 'red', label ="Cluster 1")
plt.scatter(X[y_kmeans == 1,0],X[y_kmeans == 1,1],s=100, c = 'blue', label ="Cluster 2")
plt.scatter(X[y_kmeans == 2,0],X[y_kmeans == 2,1],s=100, c = 'lightgreen', label ="Clust
plt.scatter(X[y_kmeans == 3,0],X[y_kmeans == 3,1],s=100, c = 'black', label ="Cluster 4"
plt.scatter(X[y_kmeans == 4,0],X[y_kmeans == 4,1],s=100, c = 'magenta', label ="Cluster
plt.scatter(kmeans.cluster_centers_[:,0],kmeans.cluster_centers_[:,1],s = 300, c = 'Yell
plt.title("Clusters of Customers",size = 25)
plt.xlabel("Annual Income {k$}")
plt.ylabel("Spending Scores{1 to 100}")
plt.legend()
plt.show()
```