K-Means Clustering

Clustering - grouping unlabelled data based on their similarity or proximity.

In [2]:
```
#Importing the libraries
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

Importing the dataset

In [3]:
```
df = pd.read_csv(r"C:\Users\GIRISH\Desktop\INTROTALLENT\PYTHON\ML PROJECT\Customers_spen
```

In [4]:
```
df.head()
```

Out[4]:

	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

retrieve the values from columns 3 and 4 of the df (all rows) and return them as a NumPy array.

In [5]:
```
x=df.iloc[:,[3, 4]].values
```

In [6]:
```
x
```

Out[6]:
```
array([[ 15,  39],
       [ 15,  81],
       [ 16,   6],
       [ 16,  77],
       [ 17,  40],
       [ 17,  76],
       [ 18,   6],
       [ 18,  94],
       [ 19,   3],
       [ 19,  72],
       [ 19,  14],
       [ 19,  99],
       [ 20,  15],
       [ 20,  77],
       [ 20,  13],
       [ 20,  79],
       [ 21,  35],
       [ 21,  66],
       [ 23,  29],
       [ 23,  98],
       [ 24,  35],
       [ 24,  73],
       [ 25,   5],
       [ 25,  73],
```

```
[ 28,  14],
[ 28,  82],
[ 28,  32],
[ 28,  61],
[ 29,  31],
[ 29,  87],
[ 30,   4],
[ 30,  73],
[ 33,   4],
[ 33,  92],
[ 33,  14],
[ 33,  81],
[ 34,  17],
[ 34,  73],
[ 37,  26],
[ 37,  75],
[ 38,  35],
[ 38,  92],
[ 39,  36],
[ 39,  61],
[ 39,  28],
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[ 40,  47],
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[ 54,  52],
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[ 54,  55],
[ 54,  41],
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[ 54,  57],
[ 54,  46],
[ 57,  58],
[ 57,  55],
[ 58,  60],
[ 58,  46],
```

```
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[ 60,  50],
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[ 63,  52],
[ 63,  54],
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[ 71,   9],
[ 71,  75],
[ 72,  34],
[ 72,  71],
[ 73,   5],
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[ 75,   5],
[ 75,  93],
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[ 76,  87],
[ 77,  12],
[ 77,  97],
[ 77,  36],
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[ 78,  22],
[ 78,  90],
[ 78,  17],
[ 78,  88],
[ 78,  20],
[ 78,  76],
[ 78,  16],
[ 78,  89],
```

```
[ 78,   1],
[ 78,  78],
[ 78,   1],
[ 78,  73],
[ 79,  35],
[ 79,  83],
[ 81,   5],
[ 81,  93],
[ 85,  26],
[ 85,  75],
[ 86,  20],
[ 86,  95],
[ 87,  27],
[ 87,  63],
[ 87,  13],
[ 87,  75],
[ 87,  10],
[ 87,  92],
[ 88,  13],
[ 88,  86],
[ 88,  15],
[ 88,  69],
[ 93,  14],
[ 93,  90],
[ 97,  32],
[ 97,  86],
[ 98,  15],
[ 98,  88],
[ 99,  39],
[ 99,  97],
[101,  24],
[101,  68],
[103,  17],
[103,  85],
[103,  23],
[103,  69],
[113,   8],
[113,  91],
[120,  16],
[120,  79],
[126,  28],
[126,  74],
[137,  18],
[137,  83]], dtype=int64)
```

Using the elbow method to find the optimal number of clusters

The elbow method is a technique used in clustering analysis to determine the optimal number of clusters to use for partitioning a dataset.

WCSS (within-cluster sum of squares)

- The WCSS measures the sum of the squared distances between each data point and the centroid of its assigned cluster.
- In general, as you increase the number of clusters, the WCSS will decrease since data points will be closer to the centroids of their respective clusters. However, adding too many clusters may lead to

overfitting and decrease the interpretability of the results.

Elbow Point

The "elbow point" on the WCSS plot is the point at which the rate of decrease sharply changes, creating an "elbow" shape. This point represents a balance between minimizing WCSS and avoiding too many clusters. The idea is to choose the number of clusters at this elbow point

In [7]:
```
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('The Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()
```

```
C:\Users\GIRISH\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:870: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  warnings.warn(
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g: KMeans is known to have a memory leak on Windows with MKL, when there are less chunks
than available threads. You can avoid it by setting the environment variable OMP_NUM_THR
EADS=1.
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EADS=1.
  warnings.warn(
```
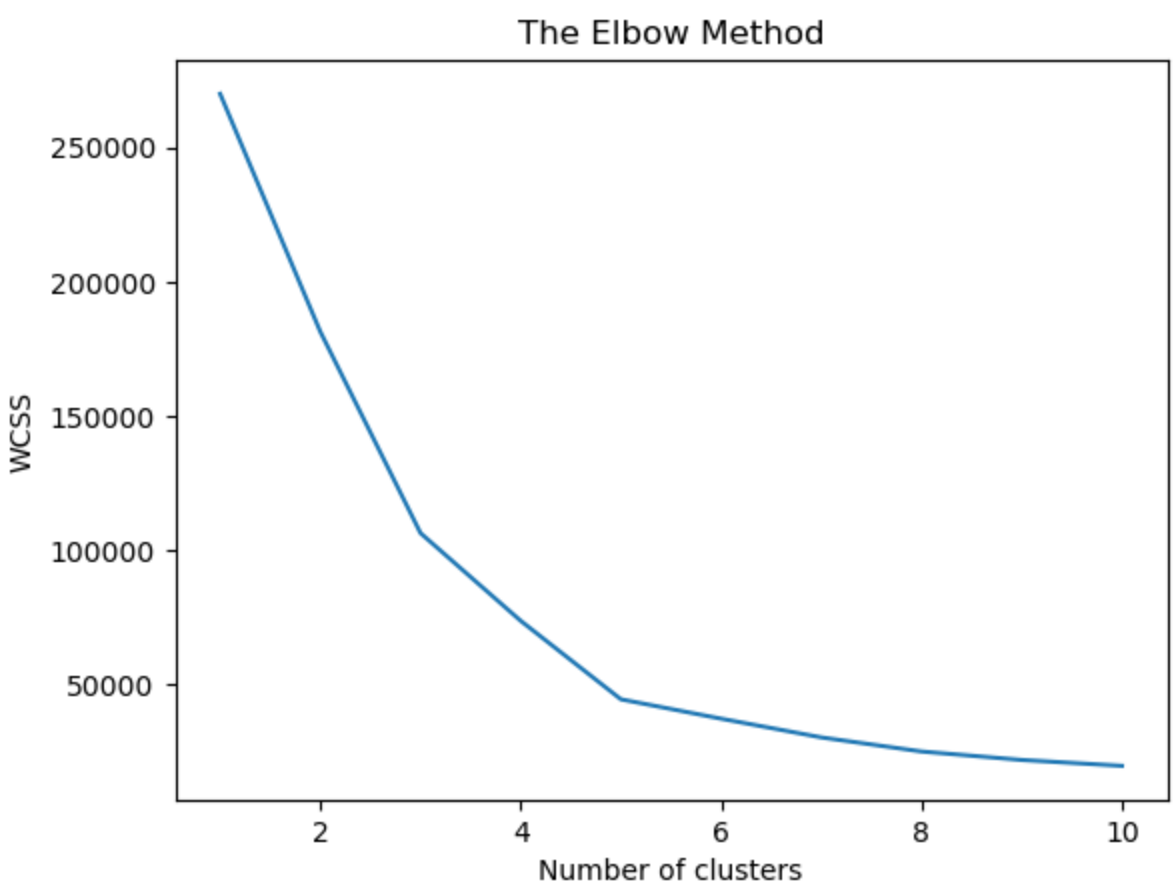



Training the K-Means model on the dataset

In [8]:
```
kmeans = KMeans(n_clusters = 5, init = 'k-means++', random_state = 100)
y_kmeans = kmeans.fit_predict(x)
```

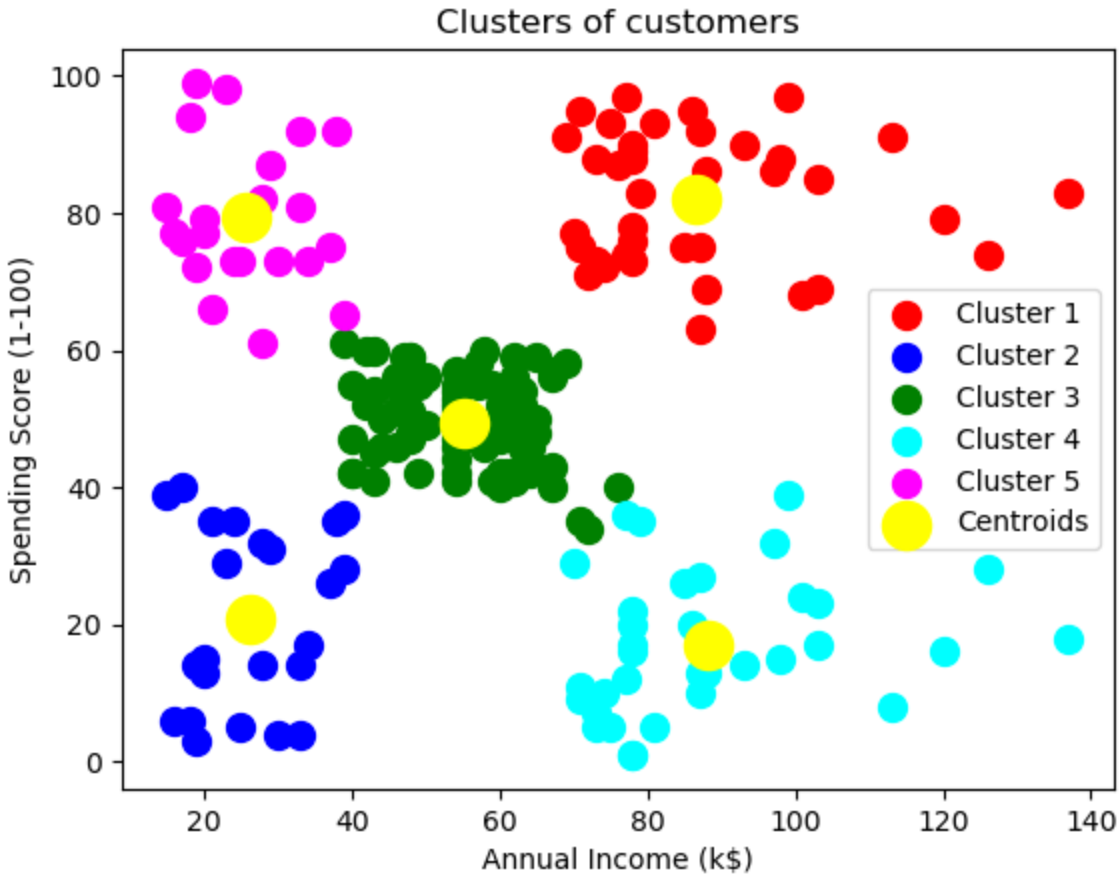
```
C:\Users\GIRISH\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:870: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  warnings.warn(
C:\Users\GIRISH\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:1382: UserWarnin
g: KMeans is known to have a memory leak on Windows with MKL, when there are less chunks
than available threads. You can avoid it by setting the environment variable OMP_NUM_THR
EADS=1.
  warnings.warn(
```

Visualising the clusters

In [9]:
```
#plt.scatter(x,y)
#plt.scatter(x[y_kmeans==0,0]) --> it will select the values from
                #col index 0 where y_kmeans is 0 (i.e. cluster number)

#plt.scatter(x[y_kmeans==0,1]) --> it will select the values from
                #col index 1 where y_kmeans is 0 (i.e. cluster number)
#s: bubble size
#c: color
#label: cluster name
```

In [10]:
```
plt.scatter(x[y_kmeans == 0, 0], x[y_kmeans == 0, 1], s = 100, c = 'red', label = 'Clust
plt.scatter(x[y_kmeans == 1, 0], x[y_kmeans == 1, 1], s = 100, c = 'blue', label = 'Clus
plt.scatter(x[y_kmeans == 2, 0], x[y_kmeans == 2, 1], s = 100, c = 'green', label = 'Clu
plt.scatter(x[y_kmeans == 3, 0], x[y_kmeans == 3, 1], s = 100, c = 'cyan', label = 'Clus
```

```
plt.scatter(x[y_kmeans == 4, 0], x[y_kmeans == 4, 1], s = 100, c = 'magenta', label = 'C
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 300, c = '
plt.title('Clusters of customers')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend()
plt.show()
```



In [ ]: