EXERCISE:10 MEANS CLUSTERING

Aim:

To determine the optimal number of clusters for a dataset using the **K-Means clustering algorithm** and the **Elbow Method**.

Procedure:

1. Import required libraries such as pandas, matplotlib, and KMeans from sklearn.cluster.
2. Load and preprocess the dataset, selecting relevant features for clustering.
3. Initialize an empty list wcss to store within-cluster sum of squares (WCSS) values.
4. Apply K-Means for different cluster numbers (e.g., 1 to 9) and record each model's WCSS.
5. Plot the number of clusters versus WCSS to form the **Elbow Curve** and identify the point where the curve bends.

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
df=pd.read_csv("C:\\Users\\kaviy\\Downloads\\Mall_Customers.csv")
df.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   Gender                  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 [2]:

```
df.head()
```

Out[2]:

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39

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	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
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 [3]:

```
sns.pairplot(df)
```

Out[3]:

```
<seaborn.axisgrid.PairGrid at 0x270326e5c30>
```

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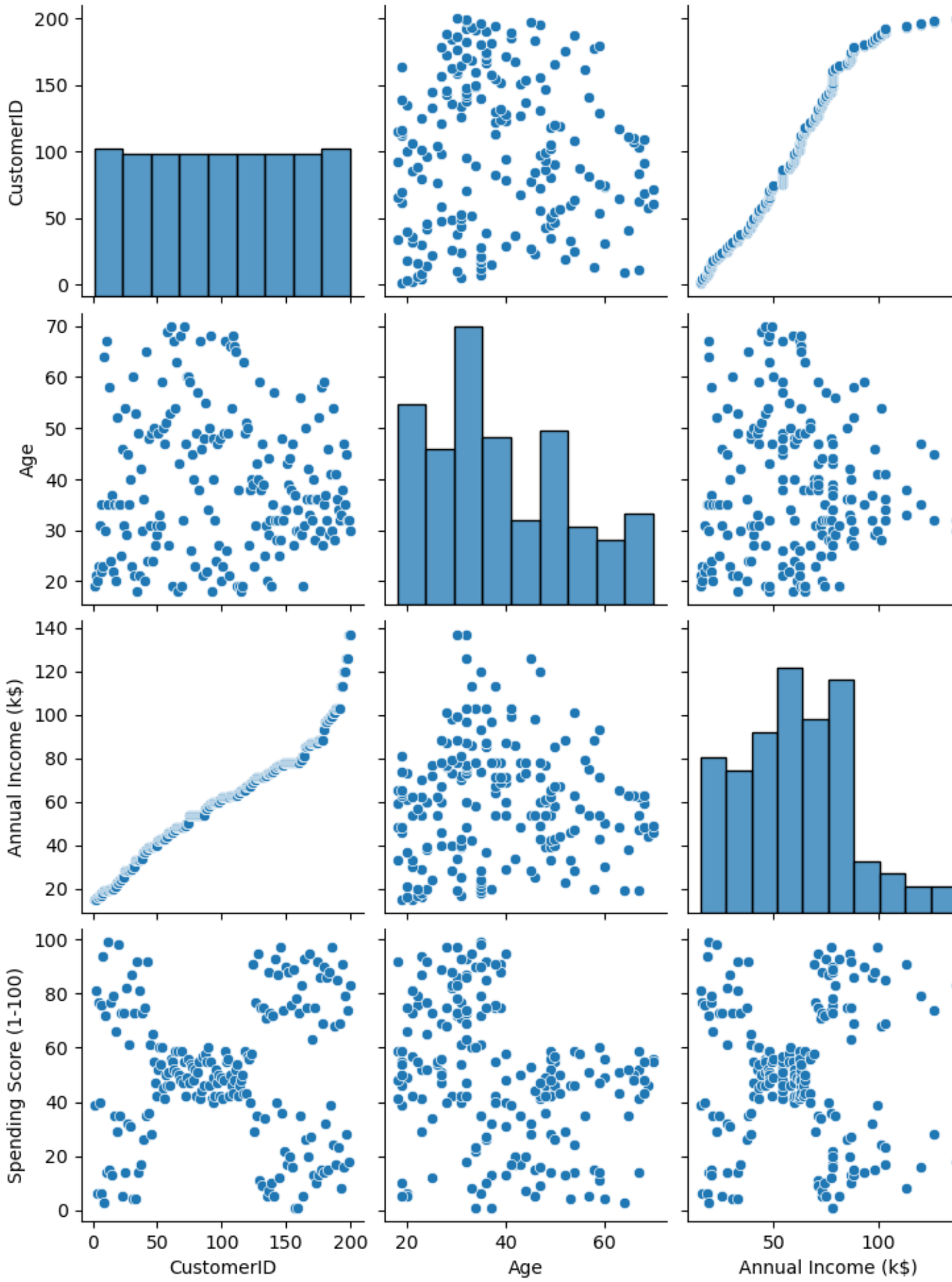

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In [4]:

```
features=df.iloc[:,[3,4]].values
from sklearn.cluster import KMeans
model=KMeans(n_clusters=5)
model.fit(features)
KMeans(n_clusters=5)
C:\Users\kaviy\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:870:
FutureWarning: 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\kaviy\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:1382:
UserWarning: 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_THREADS=1.
  warnings.warn(
```

Out[4]:

```
KMeans
```

```
KMeans(n_clusters=5)
```

In [5]:

```
Final=df.iloc[:,[3,4]]
Final['label']=model.predict(features)
Final.head()
C:\Users\kaviy\AppData\Local\Temp\ipykernel_9616\470183701.py:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  Final['label']=model.predict(features)
```

Out[5]:

	Annual Income (k$)	Spending Score (1-100)	label
0	15	39	4
1	15	81	0
2	16	6	4
3	16	77	0
4	17	40	4

In [6]:

```
sns.set_style("whitegrid")
sns.FacetGrid(Final,hue="label",height=8) \
```

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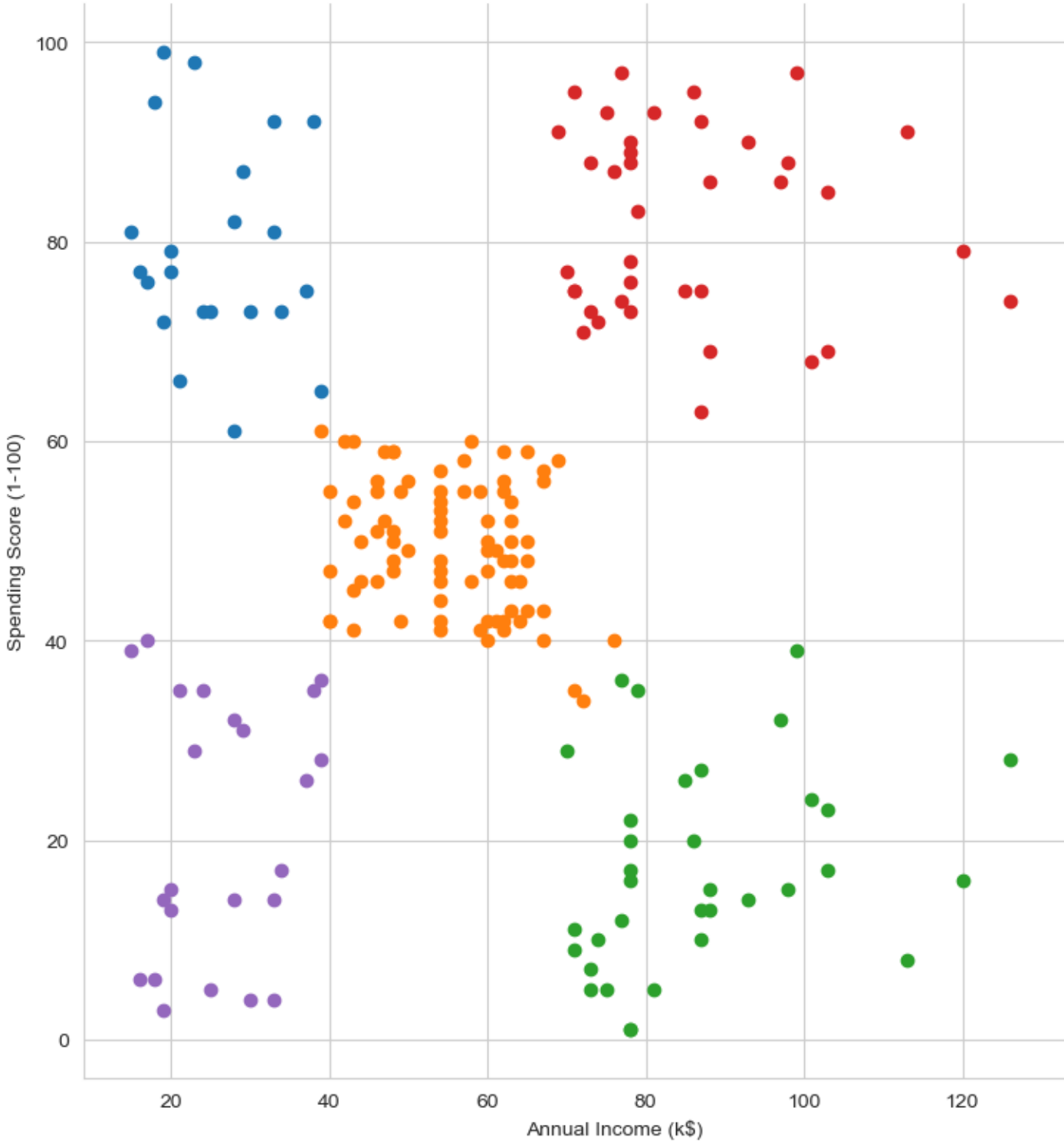
```
.map(plt.scatter,"Annual Income (k$)", "Spending Score (1-100)") \
.add_legend();
plt.show()
```



In [15]:

```
features_el=df.iloc[:,[2,3,4]].values
from sklearn.cluster import KMeans
wcss=[]
for i in range(1,10):
```

```
    model=KMeans(n_clusters=i,random_state=42)
    model.fit(features_el)
    wcss.append(model.inertia_)
plt.plot(range(1,10),wcss,marker='o')
plt.title('Elbow Method')
plt.xlabel('Number of Clusters')
plt.ylabel('WCSS')
plt.show()
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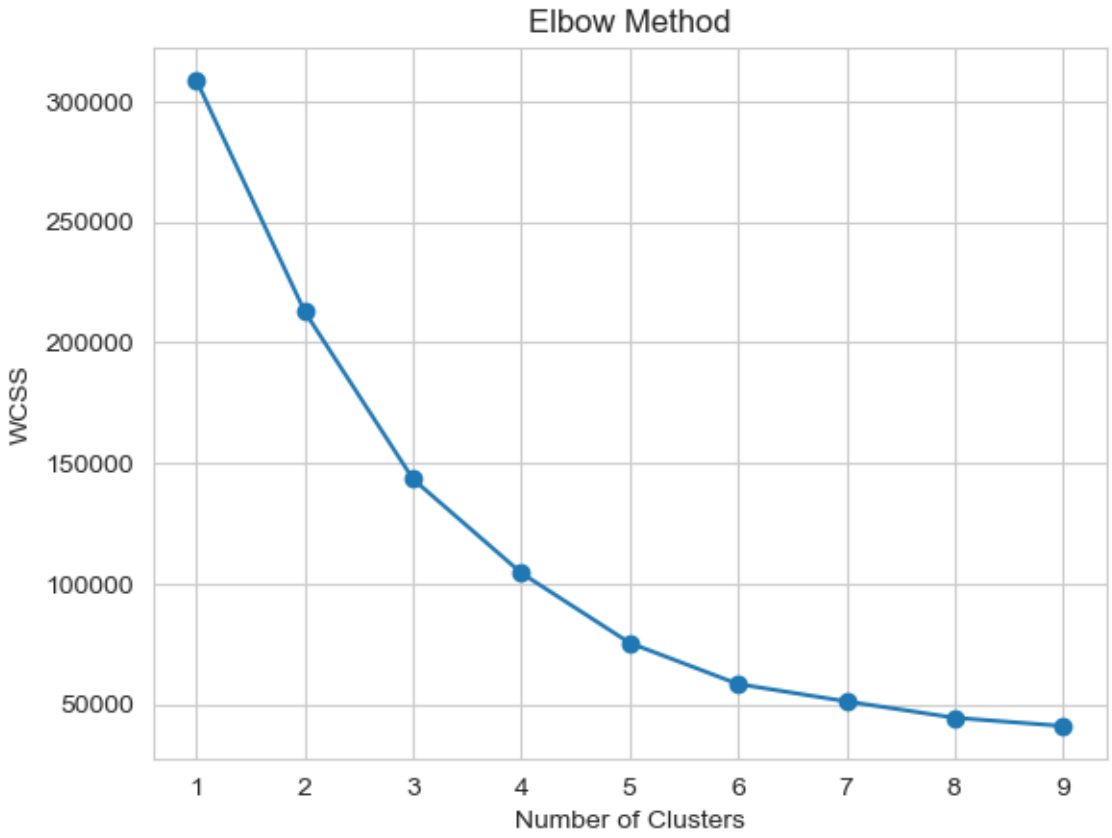

Result:

The elbow point in the graph indicates the **optimal number of clusters** for the dataset.
It shows where adding more clusters does not significantly reduce WCSS.
Thus, the K-Means model can be effectively trained using this optimal cluster count.