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

df = pd.read_csv('sales_data_sample.csv',encoding='unicode_escape')
df.head()

   ORDERNUMBER  QUANTITYORDERED  PRICEEACH  ORDERLINENUMBER
SALES  \
0        10107               30      95.70                2  2871.00

1        10121               34      81.35                5  2765.90

2        10134               41      94.74                2  3884.34

3        10145               45      83.26                6  3746.70

4        10159               49     100.00               14  5205.27


         ORDERDATE   STATUS  QTR_ID  MONTH_ID  YEAR_ID  ...  \
0   2/24/2003 0:00  Shipped       1         2     2003  ...
1    5/7/2003 0:00  Shipped       2         5     2003  ...
2    7/1/2003 0:00  Shipped       3         7     2003  ...
3   8/25/2003 0:00  Shipped       3         8     2003  ...
4  10/10/2003 0:00  Shipped       4        10     2003  ...

                    ADDRESSLINE1  ADDRESSLINE2           CITY STATE  \
0        897 Long Airport Avenue           NaN            NYC    NY
1             59 rue de l'Abbaye           NaN          Reims   NaN
2  27 rue du Colonel Pierre Avia           NaN          Paris   NaN
3             78934 Hillside Dr.           NaN       Pasadena    CA
4                7734 Strong St.           NaN  San Francisco    CA

  POSTALCODE COUNTRY TERRITORY CONTACTLASTNAME CONTACTFIRSTNAME
DEALSIZE
0      10022     USA       NaN              Yu             Kwai
Small
1      51100  France      EMEA         Henriot             Paul
Small
2      75508  France      EMEA        Da Cunha           Daniel
Medium
3      90003     USA       NaN           Young            Julie
Medium
4        NaN     USA       NaN           Brown            Julie
Medium

[5 rows x 25 columns]

df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2823 entries, 0 to 2822
Data columns (total 25 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   ORDERNUMBER       2823 non-null   int64  
 1   QUANTITYORDERED   2823 non-null   int64  
 2   PRICEEACH         2823 non-null   float64
 3   ORDERLINENUMBER   2823 non-null   int64  
 4   SALES             2823 non-null   float64
 5   ORDERDATE         2823 non-null   object 
 6   STATUS            2823 non-null   object 
 7   QTR_ID            2823 non-null   int64  
 8   MONTH_ID          2823 non-null   int64  
 9   YEAR_ID           2823 non-null   int64  
 10  PRODUCTLINE       2823 non-null   object 
 11  MSRP              2823 non-null   int64  
 12  PRODUCTCODE       2823 non-null   object 
 13  CUSTOMERNAME      2823 non-null   object 
 14  PHONE             2823 non-null   object 
 15  ADDRESSLINE1      2823 non-null   object 
 16  ADDRESSLINE2      302 non-null    object 
 17  CITY              2823 non-null   object 
 18  STATE             1337 non-null   object 
 19  POSTALCODE        2747 non-null   object 
 20  COUNTRY           2823 non-null   object 
 21  TERRITORY         1749 non-null   object 
 22  CONTACTLASTNAME   2823 non-null   object 
 23  CONTACTFIRSTNAME  2823 non-null   object 
 24  DEALSIZE          2823 non-null   object 
dtypes: float64(2), int64(7), object(16)
memory usage: 551.5+ KB
```

```
df_drop  = ['ADDRESSLINE1', 'ADDRESSLINE2', 'POSTALCODE', 'CITY', 
'TERRITORY', 'PHONE', 'STATE', 'CONTACTFIRSTNAME', 'CONTACTLASTNAME', 
'CUSTOMERNAME', 'ORDERNUMBER']
df = df.drop(df_drop, axis=1)

df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2823 entries, 0 to 2822
Data columns (total 14 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   QUANTITYORDERED  2823 non-null   int64  
 1   PRICEEACH        2823 non-null   float64
 2   ORDERLINENUMBER  2823 non-null   int64  
 3   SALES            2823 non-null   float64
 4   ORDERDATE        2823 non-null   object 
 5   STATUS            2823 non-null   object 
 6   QTR_ID            2823 non-null   int64  
 7   MONTH_ID          2823 non-null   int64  
 8   YEAR_ID           2823 non-null   int64  
 9   PRODUCTLINE       2823 non-null   object 
 10  MSRP              2823 non-null   int64  
 11  PRODUCTCODE       2823 non-null   object 
 12  COUNTRY           2823 non-null   object 
 13  DEALSIZE          2823 non-null   object 
dtypes: float64(2), int64(6), object(6)
memory usage: 308.9+ KB
```

```
for col in df.columns.values:
    print(df[col].value_counts())
```

```
34    112
21    103
46    101
27    100
31     97
41     97
45     97
26     96
29     94
48     94
25     94
20     93
33     92
22     92
32     91
24     91
38     91
49     91
36     89
44     89
37     87
43     85
39     84
28     82
40     78
42     76
30     75
23     73
35     71
47     70
50     65
55     16
66      5
15      4
51      4
```

```
61      3
18      3
60      3
76      3
59      3
56      3
19      3
64      3
10      2
6       2
11      2
54      2
70      2
97      1
85      1
62      1
52      1
16      1
13      1
58      1
65      1
12      1
77      1
Name: QUANTITYORDERED, dtype: int64
100.00    1304
59.87        6
96.34        6
57.73        5
80.55        5
          ... 
48.30        1
87.96        1
36.21        1
98.48        1
62.24        1
Name: PRICEEACH, Length: 1016, dtype: int64
1     307
2     291
3     270
4     256
5     239
6     221
7     197
8     187
9     165
10    141
11    128
12    110
13     97
```

```
14     81
15     56
16     42
17     25
18     10
Name: ORDERLINENUMBER, dtype: int64
3003.00    3
5464.69    2
2257.92    2
5004.80    2
2172.48    2
          ..
2312.24    1
2793.71    1
1908.28    1
3441.37    1
2116.16    1
Name: SALES, Length: 2763, dtype: int64
11/14/2003 0:00    38
11/24/2004 0:00    35
11/12/2003 0:00    34
11/17/2004 0:00    32
11/4/2004 0:00     29
                   ..
4/20/2004 0:00      1
8/4/2004 0:00       1
2/2/2004 0:00       1
8/28/2004 0:00      1
4/21/2003 0:00      1
Name: ORDERDATE, Length: 252, dtype: int64
Shipped       2617
Cancelled       60
Resolved        47
On Hold         44
In Process      41
Disputed        14
Name: STATUS, dtype: int64
4    1094
1     665
2     561
3     503
Name: QTR_ID, dtype: int64
11    597
10    317
5     252
1     229
2     224
3     212
8     191
```

```
12    180
4     178
9     171
7     141
6     131
Name: MONTH_ID, dtype: int64
2004    1345
2003    1000
2005     478
Name: YEAR_ID, dtype: int64
Classic Cars        967
Vintage Cars        607
Motorcycles         331
Planes              306
Trucks and Buses    301
Ships               234
Trains               77
Name: PRODUCTLINE, dtype: int64
118    104
99     103
136     80
62      78
68      77
      ...
73      23
41      22
170     22
71      22
92      22
Name: MSRP, Length: 80, dtype: int64
S18_3232    52
S10_1949    28
S24_1444    28
S10_4962    28
S24_2840    28
            ..
S18_1749    22
S24_2887    22
S24_3969    22
S18_4409    22
S18_4933    22
Name: PRODUCTCODE, Length: 109, dtype: int64
USA            1004
Spain           342
France          314
Australia       185
UK              144
Italy           113
Finland          92
```

```
Norway            85
Singapore         79
Canada            70
Denmark           63
Germany           62
Sweden            57
Austria           55
Japan             52
Belgium           33
Switzerland       31
Philippines       26
Ireland           16
Name: COUNTRY, dtype: int64
Medium    1384
Small     1282
Large      157
Name: DEALSIZE, dtype: int64
```

```python
df.drop(columns=['ORDERDATE','STATUS','MONTH_ID','QTR_ID','YEAR_ID'],i
nplace=True)
df.head()
```

```
   QUANTITYORDERED  PRICEEACH  ORDERLINENUMBER    SALES  PRODUCTLINE
MSRP  \
0               30      95.70                2  2871.00  Motorcycles
95
1               34      81.35                5  2765.90  Motorcycles
95
2               41      94.74                2  3884.34  Motorcycles
95
3               45      83.26                6  3746.70  Motorcycles
95
4               49     100.00               14  5205.27  Motorcycles
95

  PRODUCTCODE COUNTRY DEALSIZE
0    S10_1678     USA    Small
1    S10_1678  France    Small
2    S10_1678  France   Medium
3    S10_1678     USA   Medium
4    S10_1678     USA   Medium
```

```python
from sklearn.preprocessing import LabelEncoder
def convert_categories(col):
    le = LabelEncoder()
    df[col] = le.fit_transform(df[col].values)

categories = ['PRODUCTLINE','PRODUCTCODE','COUNTRY','DEALSIZE']
for col in categories:
    convert_categories(col)
```

```
df.head()
```

```
   QUANTITYORDERED  PRICEEACH  ORDERLINENUMBER    SALES  PRODUCTLINE
MSRP  \
0               30      95.70                2  2871.00            1
95
1               34      81.35                5  2765.90            1
95
2               41      94.74                2  3884.34            1
95
3               45      83.26                6  3746.70            1
95
4               49     100.00               14  5205.27            1
95

   PRODUCTCODE  COUNTRY  DEALSIZE
0            0       18         2
1            0        6         2
2            0        6         1
3            0       18         1
4            0       18         1
```

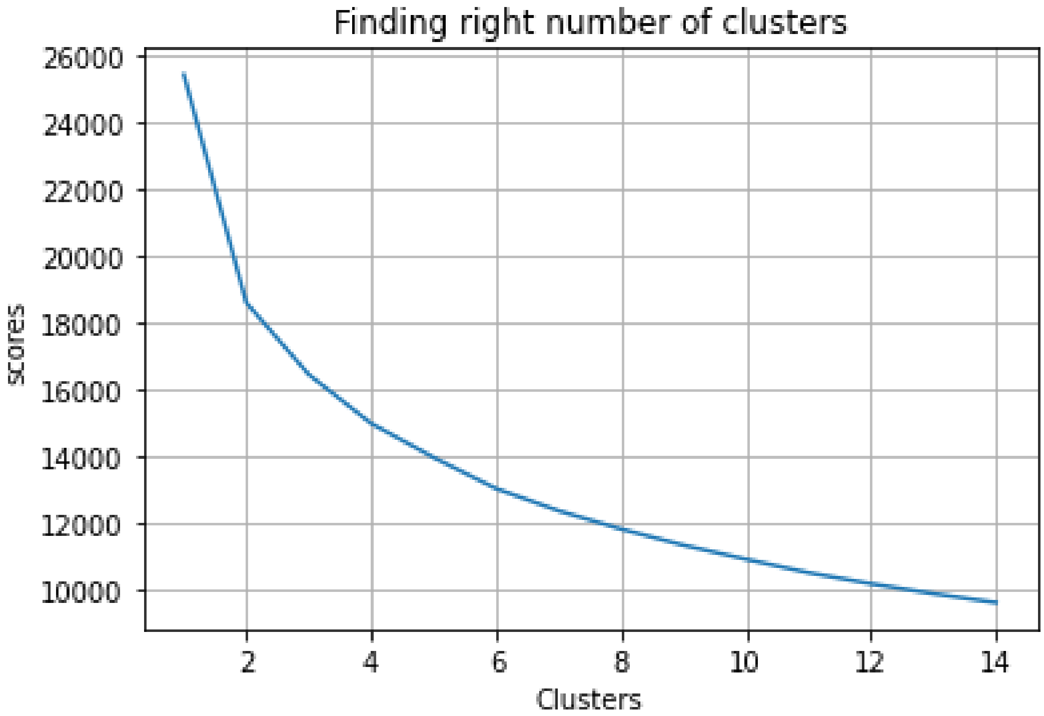
```
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
data = sc.fit_transform(df)
```

Elbow Method

Finding optimal numbers of clusters is elbow method For each value of K, we are calculating WCSS (Within-Cluster Sum of Square). WCSS is the sum of squared distance between each point and the centroid in a cluster.When we plot the WCSS with the K value, the plot looks like an Elbow

```
from sklearn.cluster import KMeans
wcss = []
for k in range(1,15):
    kmeans = KMeans(n_clusters=k,init='k-means++',random_state=15)
    kmeans.fit(data)
    wcss.append(kmeans.inertia_)

k = list(range(1,15))
plt.plot(k,wcss)
plt.xlabel('Clusters')
plt.ylabel('scores')
plt.title('Finding right number of clusters')
plt.grid()
plt.show()
```



At k=4, the graph starts to move almost parallel to the X-axis. The K value corresponding to this point is the optimal K value or an optimal number of clusters.