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

df = pd.read_csv('sales_data_sample.csv', encoding = 'latin1')

df
```

```
      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
...           ...              ...        ...              ...       ..
.
2818        10350               20     100.00               15
2244.40
2819        10373               29     100.00                1
3978.51
2820        10386               43     100.00                4
5417.57
2821        10397               34      62.24                1
2116.16
2822        10414               47      65.52                9
3079.44

            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  ...
...               ...       ...     ...       ...      ...  ...
2818   12/2/2004 0:00   Shipped       4        12     2004  ...
2819   1/31/2005 0:00   Shipped       1         1     2005  ...
2820    3/1/2005 0:00  Resolved       1         3     2005  ...
2821   3/28/2005 0:00   Shipped       1         3     2005  ...
2822    5/6/2005 0:00   On Hold       2         5     2005  ...

                       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
...                             ...           ...            ...   ...
2818             C/ Moralzarzal, 86           NaN         Madrid   NaN
2819                   Torikatu 38            NaN           Oulu   NaN
2820             C/ Moralzarzal, 86           NaN         Madrid   NaN
2821          1 rue Alsace-Lorraine           NaN       Toulouse   NaN
2822             8616 Spinnaker Dr.           NaN         Boston    MA

     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
...         ...      ...       ...             ...               ...
...
2818      28034    Spain      EMEA          Freyre             Diego
Small
2819      90110  Finland      EMEA       Koskitalo             Pirkko
Medium
2820      28034    Spain      EMEA          Freyre             Diego
Medium
2821      31000   France      EMEA          Roulet            Annette
Small
2822      51003      USA       NaN         Yoshido              Juri
Medium

[2823 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.describe()

        ORDERNUMBER  QUANTITYORDERED    PRICEEACH  ORDERLINENUMBER  \
count   2823.000000      2823.000000  2823.000000      2823.000000
mean   10258.725115        35.092809    83.658544         6.466171
std       92.085478         9.741443    20.174277         4.225841
min    10100.000000         6.000000    26.880000         1.000000
25%    10180.000000        27.000000    68.860000         3.000000
50%    10262.000000        35.000000    95.700000         6.000000
75%    10333.500000        43.000000   100.000000         9.000000
max    10425.000000        97.000000   100.000000        18.000000

              SALES       QTR_ID     MONTH_ID     YEAR_ID          MSRP

count   2823.000000  2823.000000  2823.000000  2823.00000  2823.000000

mean    3553.889072     2.717676     7.092455  2003.81509   100.715551
```

```
std     1841.865106     1.203878     3.656633     0.69967    40.187912

min      482.130000     1.000000     1.000000  2003.00000    33.000000

25%     2203.430000     2.000000     4.000000  2003.00000    68.000000

50%     3184.800000     3.000000     8.000000  2004.00000    99.000000

75%     4508.000000     4.000000    11.000000  2004.00000   124.000000

max    14082.800000     4.000000    12.000000  2005.00000   214.000000
```

```
df.columns
```

```
Index(['ORDERNUMBER', 'QUANTITYORDERED', 'PRICEEACH',
'ORDERLINENUMBER',
       'SALES', 'ORDERDATE', 'STATUS', 'QTR_ID', 'MONTH_ID',
'YEAR_ID',
       'PRODUCTLINE', 'MSRP', 'PRODUCTCODE', 'CUSTOMERNAME', 'PHONE',
       'ADDRESSLINE1', 'ADDRESSLINE2', 'CITY', 'STATE', 'POSTALCODE',
       'COUNTRY', 'TERRITORY', 'CONTACTLASTNAME', 'CONTACTFIRSTNAME',
       'DEALSIZE'],
      dtype='object')
```

```
df.shape
```

```
(2823, 25)
```

```
df = df[['QUANTITYORDERED', 'ORDERLINENUMBER']].dropna(axis=0)
```

```
from sklearn.cluster import KMeans

# K-Means clustering with Elbow method
wcss = []  # Within-Cluster Sum of Squares
for i in range(1, 11):
    clustering = KMeans(n_clusters=i, init='k-means++',
random_state=42)
    clustering.fit(df)
    wcss.append(clustering.inertia_)

ks = list(range(1, 11))
sns.lineplot(x=ks, y=wcss)
plt.title('Elbow Method for Optimal k')
plt.xlabel('Number of Clusters')
plt.ylabel('WCSS')
plt.show()
```

```
C:\Users\Shubham\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1446: 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=12.
  warnings.warn(
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```
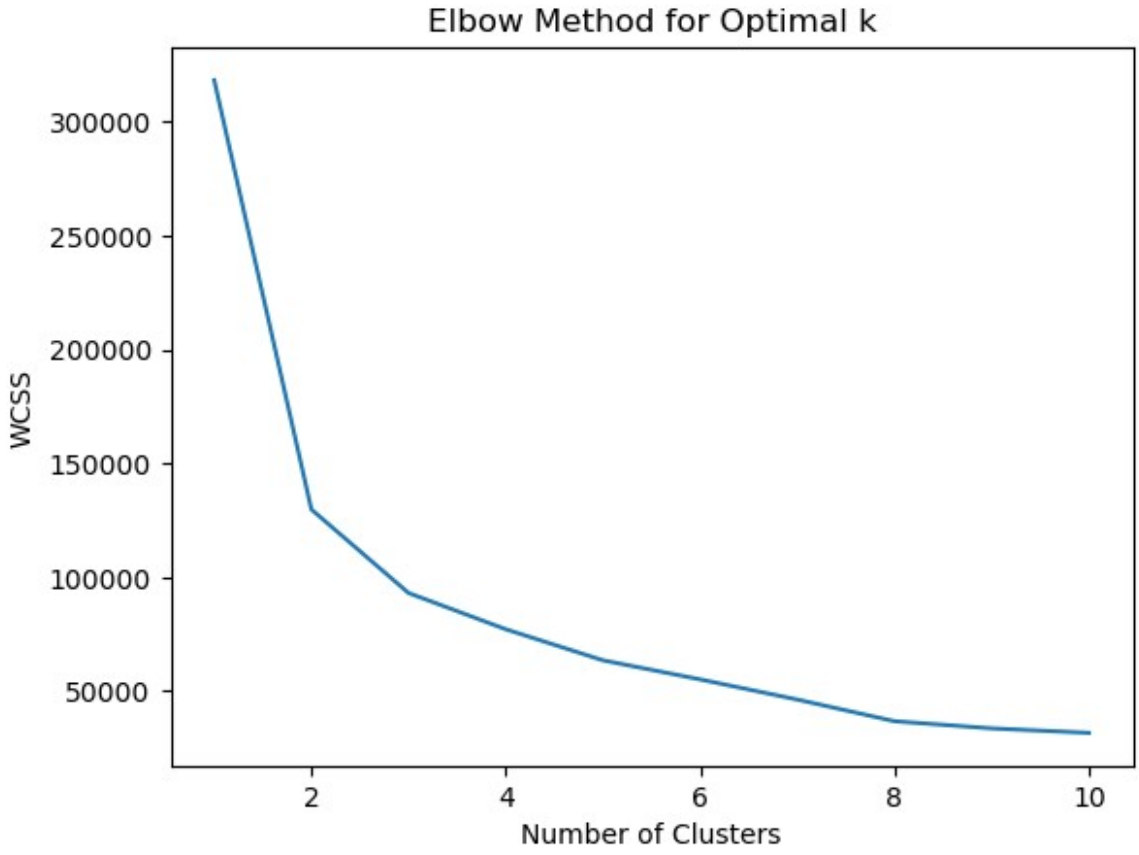
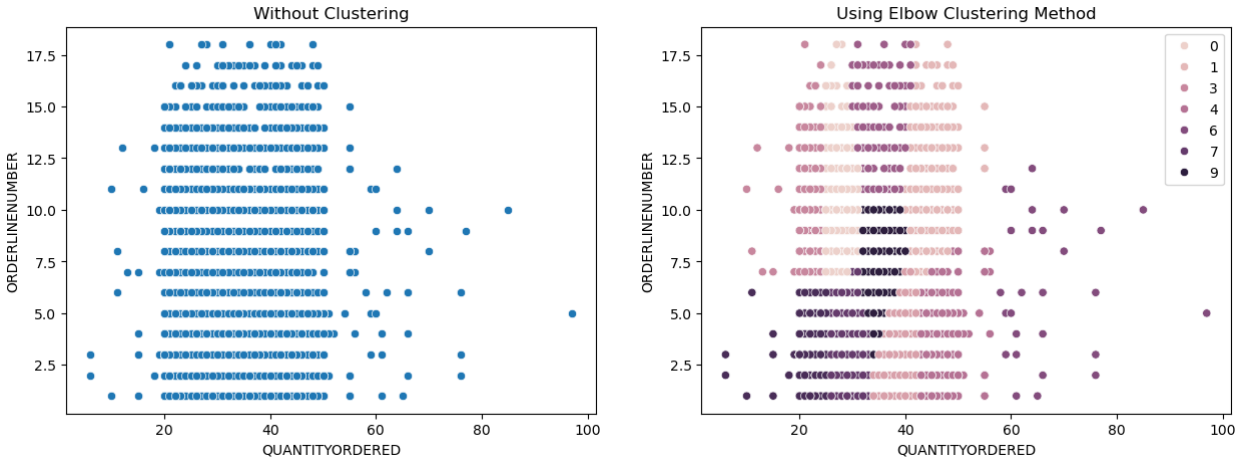




```
# Plot without clustering and with clustering
fig, axes = plt.subplots(nrows=1, ncols=2, figsize=(15, 5))
sns.scatterplot(ax=axes[0], data=df, x='QUANTITYORDERED',
y='ORDERLINENUMBER').set_title('Without Clustering')
sns.scatterplot(ax=axes[1], data=df, x='QUANTITYORDERED',
y='ORDERLINENUMBER', hue=clustering.labels_).set_title('Using Elbow
Clustering Method')

Text(0.5, 1.0, 'Using Elbow Clustering Method')
```




```
df.describe().T
```

```
                    count        mean        std   min    25%    50%    75%
max
QUANTITYORDERED    2823.0   35.092809   9.741443   6.0   27.0   35.0   43.0
97.0
ORDERLINENUMBER    2823.0    6.466171   4.225841   1.0    3.0    6.0    9.0
18.0
```

```
from sklearn.preprocessing import StandardScaler

# Scaling data
scaler = StandardScaler()
scaled_data = scaler.fit_transform(df)

# K-Means clustering with scaled data
wcss_sc = []
for i in range(1, 11):
    clustering_sc = KMeans(n_clusters=i, init='k-means++',
random_state=42)
    clustering_sc.fit(scaled_data)
    wcss_sc.append(clustering_sc.inertia_)

sns.lineplot(x=ks, y=wcss_sc)
plt.title('Elbow Method for Optimal k (Scaled Data)')
plt.xlabel('Number of Clusters')
plt.ylabel('WCSS')
plt.show()
```

```
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```
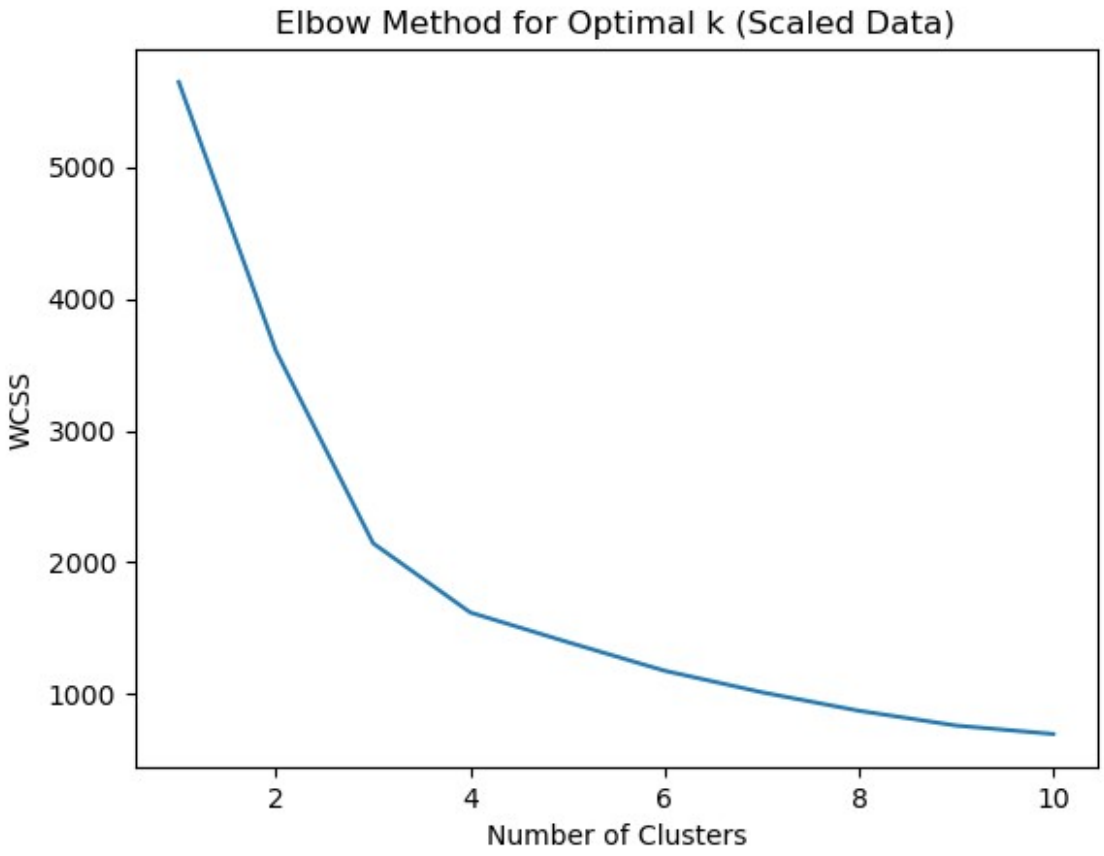
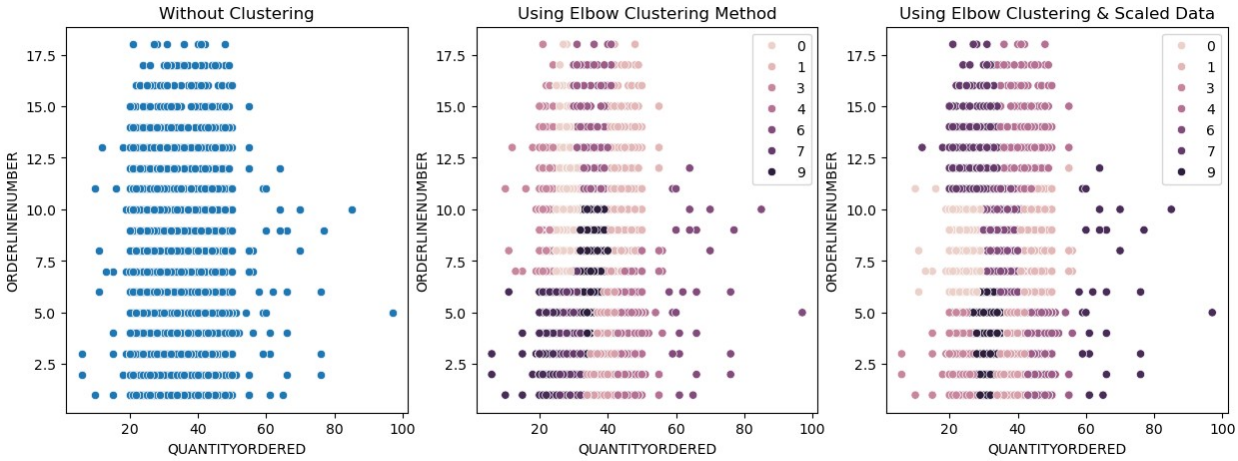

```
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=12.
  warnings.warn(
```




```
# Plot without clustering, with original clustering, and with scaled
clustering
fig, axes = plt.subplots(nrows=1, ncols=3, figsize=(15, 5))
sns.scatterplot(ax=axes[0], data=df, x='QUANTITYORDERED',
y='ORDERLINENUMBER').set_title('Without Clustering')
sns.scatterplot(ax=axes[1], data=df, x='QUANTITYORDERED',
y='ORDERLINENUMBER', hue=clustering.labels_).set_title('Using Elbow
Clustering Method')
sns.scatterplot(ax=axes[2], data=df, x='QUANTITYORDERED',
y='ORDERLINENUMBER', hue=clustering_sc.labels_).set_title('Using Elbow
Clustering & Scaled Data')

Text(0.5, 1.0, 'Using Elbow Clustering & Scaled Data')
```


Without Clustering
Using Elbow Clustering Method
Using Elbow Clustering & Scaled Data
ORDERLINENUMBER
QUANTITYORDERED
0
1
3
4
6
7
9