In [149]:

```
import numpy as np
import pandas as pd
import seaborn as sb
import matplotlib.pyplot as plt
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.decomposition import TruncatedSVD
from sklearn.metrics import confusion_matrix, accuracy_score
from sklearn.linear_model import LogisticRegression
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.cluster import KMeans
import plotly.express as px
```

In [148]:

```
pip install plotly
```

```
Collecting plotlyNote: you may need to restart the kernel to use updated packages.
  Downloading plotly-5.15.0-py2.py3-none-any.whl (15.5 MB)
Requirement already satisfied: packaging in c:\users\mannahil miftah\anaconda3\lib\site-p
ackages (from plotly) (21.0)
Collecting tenacity>=6.2.0
  Downloading tenacity-8.2.2-py3-none-any.whl (24 kB)
Requirement already satisfied: pyparsing>=2.0.2 in c:\users\mannahil miftah\anaconda3\lib
\site-packages (from packaging->plotly) (3.0.4)
Installing collected packages: tenacity, plotly
Successfully installed plotly-5.15.0 tenacity-8.2.2
```

Loading & Exploring Dataset

In [126]:

```
data = pd.read_excel(r'C:\Users\Mannahil Miftah\Downloads\superstore.xls')
data.head(5)
```

Out[126]:

	Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	...	Postal Code	Region	Product ID
0	1	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-BO-10001798
1	2	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-CH-10000454
2	3	CA-2016-138688	2016-06-12	2016-06-16	Second Class	DV-13045	Darrin Van Huff	Corporate	United States	Los Angeles	...	90036	West	OFF-LA-10000240
3	4	US-2015-108966	2015-10-11	2015-10-18	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	33311	South	FUR-TA-10000577
4	5	US-2015-	2015-	2015-	Standard	SO-20335	Sean	Consumer	United	Fort	...	33311	South	OFF-ST-

	Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	...	Postal Code	Region	Product ID
4	5	2015-108966	10-11	10-18	Class	SO-20335	O'Donnell	Consumer	States	Lauderdale	...	33311	South	10000760

5 rows × 21 columns

In [28]:

```
# dropping row id column

data.drop('Row ID',inplace=True,axis=1)
data.head(2)
```

Out[28]:

	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	State	Postal Code	Region	Product ID
0	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	Kentucky	42420	South	FUR-BO-10001798
1	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	Kentucky	42420	South	FUR-CH-10000454

In [29]:

```
data.columns
```

Out[29]:

```
Index(['Order ID', 'Order Date', 'Ship Date', 'Ship Mode', 'Customer ID',
       'Customer Name', 'Segment', 'Country', 'City', 'State', 'Postal Code',
       'Region', 'Product ID', 'Category', 'Sub-Category', 'Product Name',
       'Sales', 'Quantity', 'Discount', 'Profit'],
      dtype='object')
```

In [30]:

```
data.shape
```

Out[30]:

```
(9994, 20)
```

In [128]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9994 entries, 0 to 9993
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype         
---  ------         --------------  -----         
 0   Row ID         9994 non-null   int64         
 1   Order ID       9994 non-null   object        
 2   Order Date     9994 non-null   datetime64[ns]
 3   Ship Date      9994 non-null   datetime64[ns]
 4   Ship Mode      9994 non-null   object        
 5   Customer ID    9994 non-null   object        
 6   Customer Name  9994 non-null   object        
 7   Segment        9994 non-null   object        
 8   Country        9994 non-null   object        
 9   City           9994 non-null   object        
 10  State          9994 non-null   object        
 11  Postal Code    9994 non-null   int64         
 12  Region         9994 non-null   object        
 13  Product ID     9994 non-null   object        
```

```
 14  Category        9994 non-null   object
 15  Sub-Category    9994 non-null   object
 16  Product Name    9994 non-null   object
 17  Sales           9994 non-null   float64
 18  Quantity        9994 non-null   int64
 19  Discount        9994 non-null   float64
 20  Profit          9994 non-null   float64
dtypes: datetime64[ns](2), float64(3), int64(3), object(13)
memory usage: 1.6+ MB
```

In [127]:

```
data.describe()
```

Out[127]:

	Row ID	Postal Code	Sales	Quantity	Discount	Profit
count	9994.000000	9994.000000	9994.000000	9994.000000	9994.000000	9994.000000
mean	4997.500000	55190.379428	229.858001	3.789574	0.156203	28.656896
std	2885.163629	32063.693350	623.245101	2.225110	0.206452	234.260108
min	1.000000	1040.000000	0.444000	1.000000	0.000000	-6599.978000
25%	2499.250000	23223.000000	17.280000	2.000000	0.000000	1.728750
50%	4997.500000	56430.500000	54.490000	3.000000	0.200000	8.666500
75%	7495.750000	90008.000000	209.940000	5.000000	0.200000	29.364000
max	9994.000000	99301.000000	22638.480000	14.000000	0.800000	8399.976000

In [32]:

```
#printing values of all attributes to identify if any attribute has ?

allColumns = data.columns
for c in allColumns:
    missed = data[c].isin(['?']).sum()
    if missed > 0:
        print(c, "\t", missed)
```

In [33]:

```
#checking for null values
data.isnull().values.any()
```

Out[33]:

```
False
```

ANALYSIS AND VISUALIZATION

Region wise Sales

In [35]:

```
top_regions = data.groupby('Region')['Sales'].sum()
top_regions.sort_values(ascending = False)
```

Out[35]:

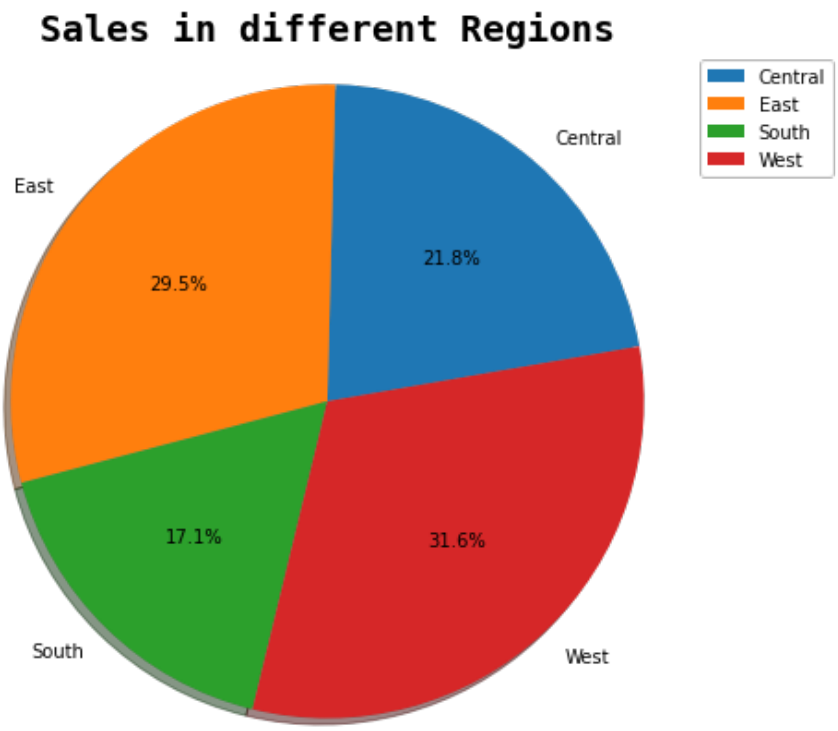
```
Region
West       725457.8245
East       678781.2400
Central    501239.8908
South      391721.9050
Name: Sales, dtype: float64
```

In [36]:

```
plt.figure(figsize=[10,7])
plt.pie(top_regions.values, labels=top_regions.index, startangle=10, shadow=True, autopct='%1.1f%%')
plt.title('Sales in different Regions', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'fontweight': 'bold'})
plt.legend()
plt.axis('equal')
```

Out[36]:

```
(-1.111985460272655,
 1.1148889262423145,
 -1.111652912479386,
 1.1043378590642272)
```



State wise Sales

In [37]:

```
top_10_states = data.groupby('State')['Sales'].sum()
top_10_states = pd.DataFrame(top_10_states)
top_10_states =  top_10_states.sort_values(by = ['Sales'], ascending = False)
top_10_states = top_10_states.reset_index()
top_10_states.head(2)
```

Out[37]:

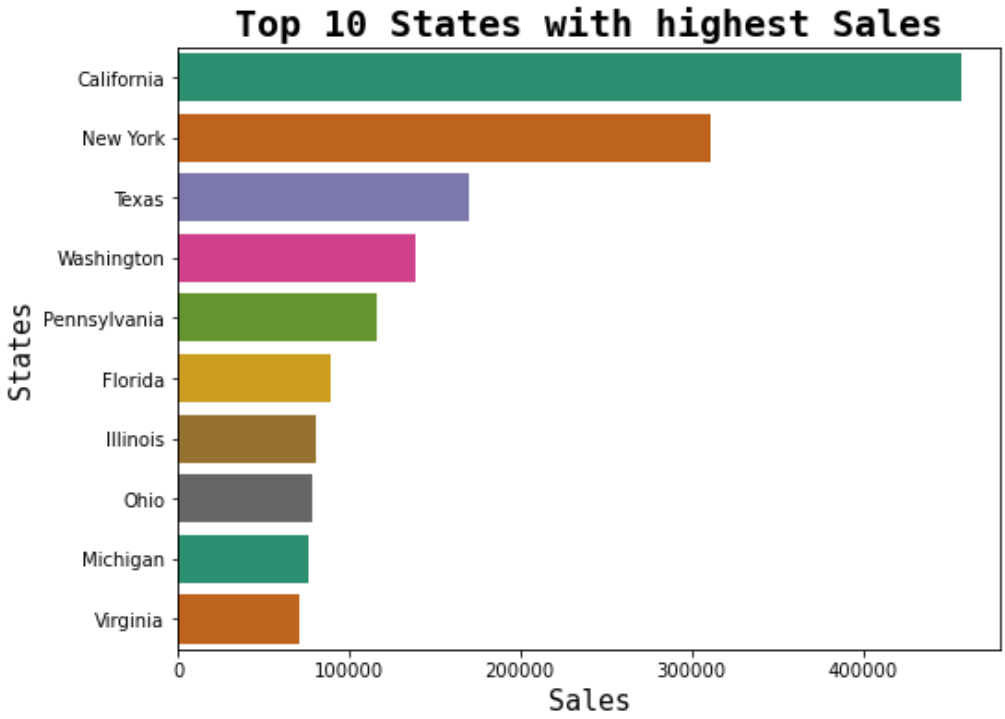
	State	Sales
0	California	457687.6315
1	New York	310876.2710

In [129]:

```
plt.figure(figsize=[8,6])
sb.barplot(data = top_10_states.head(10), x = 'Sales', y = "State", palette = 'Dark2')
plt.title('Top 10 States with highest Sales', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'fontweight': 'bold'})
plt.xlabel('Sales', fontdict={'fontname':'Monospace', 'fontsize': 15,})
plt.ylabel('States', fontdict={'fontname':'Monospace', 'fontsize': 15,})
```

Out[129]:

```
Text(0, 0.5, 'States')
```



City wise Sales

In [39]:

```
top_10_city = data.groupby('City')['Sales'].sum()
top_10_city = pd.DataFrame(top_10_city)
top_10_city =  top_10_city.sort_values(by = ['Sales'], ascending = False)
top_10_city = top_10_city.reset_index()
top_10_city.head(2)
```

Out[39]:

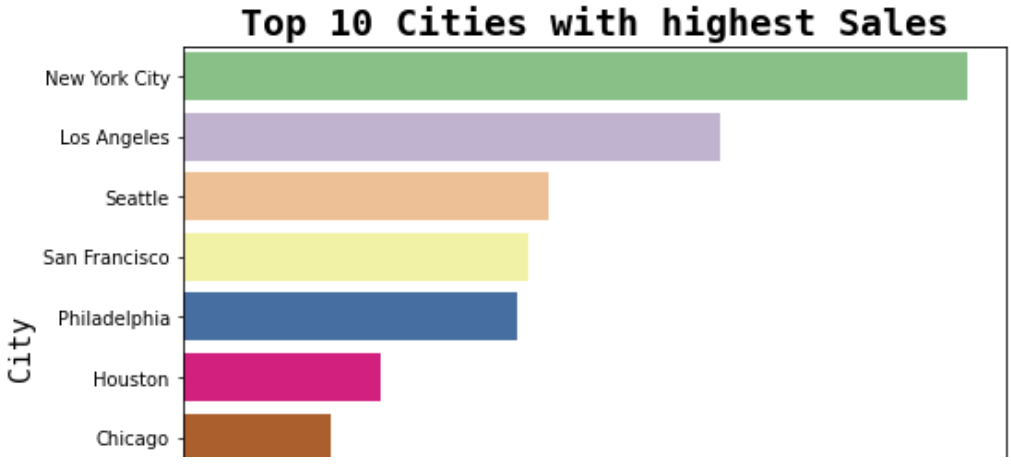
	City	Sales
0	New York City	256368.161
1	Los Angeles	175851.341

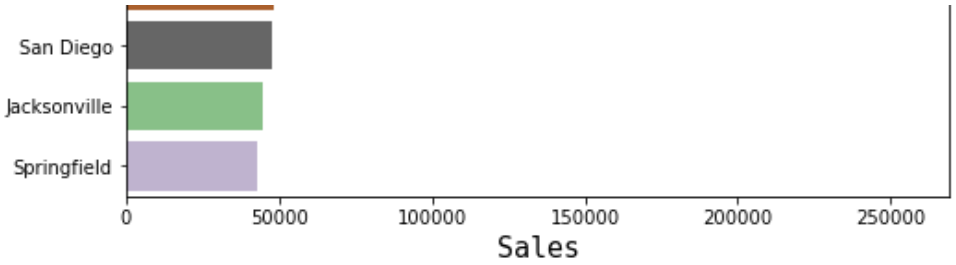
In [40]:

```
plt.figure(figsize=[8,6])
sb.barplot(data = top_10_city.head(10), x = 'Sales', y = "City", palette = 'Accent')
plt.title('Top 10 Cities with highest Sales', fontdict={'fontname': 'Monospace', 'fontsiz
e': 20, 'fontweight': 'bold'})
plt.xlabel('Sales', fontdict={'fontname':'Monospace', 'fontsize': 15,})
plt.ylabel('City', fontdict={'fontname':'Monospace', 'fontsize': 15,})
```

Out[40]:

```
Text(0, 0.5, 'City')
```





Segment wise Sales

In [41]:

```
seg = data.groupby('Segment')['Sales'].sum()
seg.sort_values(ascending = False)
```

Out[41]:

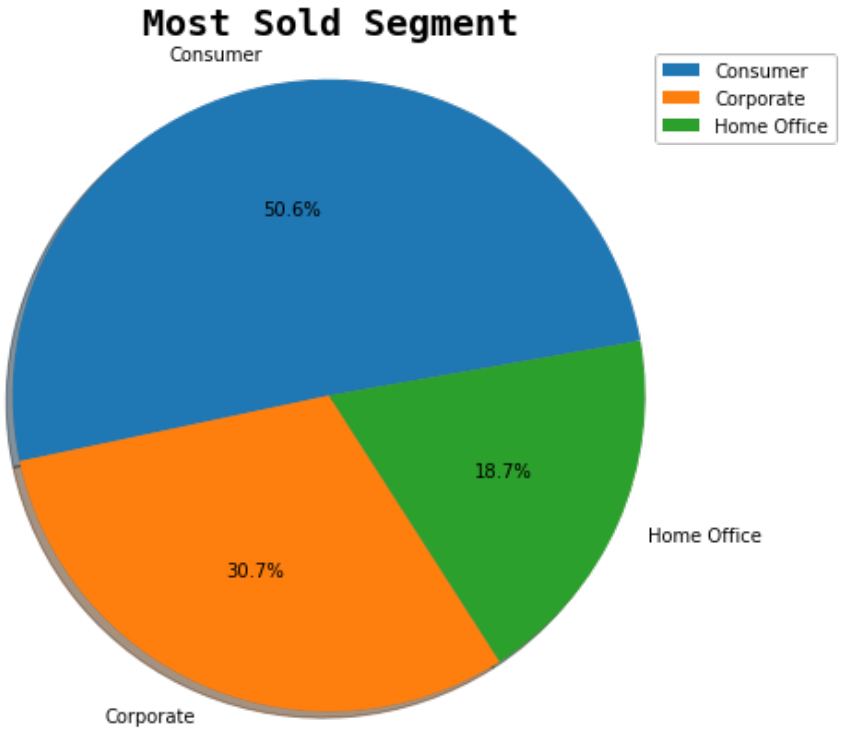
```
Segment
Consumer        1.161401e+06
Corporate       7.061464e+05
Home Office     4.296531e+05
Name: Sales, dtype: float64
```

In [42]:

```
plt.figure(figsize=[10,7])
plt.pie(seg.values, labels=seg.index, startangle=10, shadow=True, autopct='%1.1f%%')
plt.title('Most Sold Segment', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'fontw
eight': 'bold'})
plt.legend()
plt.axis('equal')
```

Out[42]:

```
(-1.108538725018818,
 1.1203756146753903,
 -1.1111562974085698,
 1.107824621431294)
```



Product Category wise Sales

In [43]:

```
cat = data.groupby('Category')['Sales'].sum()
cat.sort_values(ascending = False).head(10)
```

Out[43]:

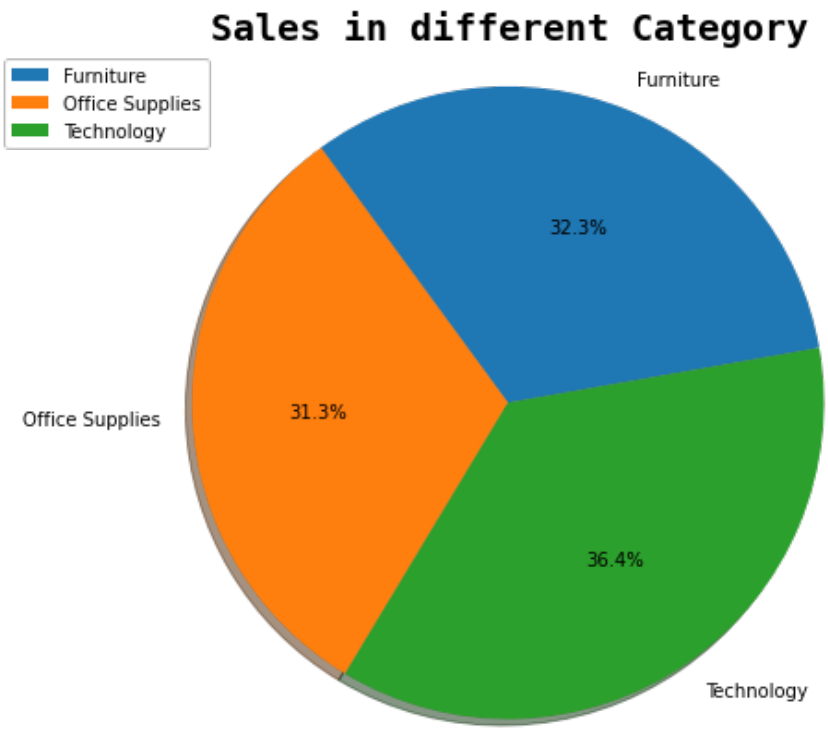
```
Category
Technology         836154.0330
Furniture          741999.7953
Office Supplies    719047.0320
Name: Sales, dtype: float64
```

In [44]:

```
plt.figure(figsize=[10,7])
plt.pie(cat.values, labels=cat.index, startangle=10, shadow=True, autopct='%1.1f%%')
plt.title('Sales in different Category', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'fontweight': 'bold'})
plt.legend()
plt.axis('equal')
```

Out[44]:

```
(-1.1077197274592372,
 1.1193567276878402,
 -1.1062549449980708,
 1.1143698714164236)
```



Analyzing sub-category column

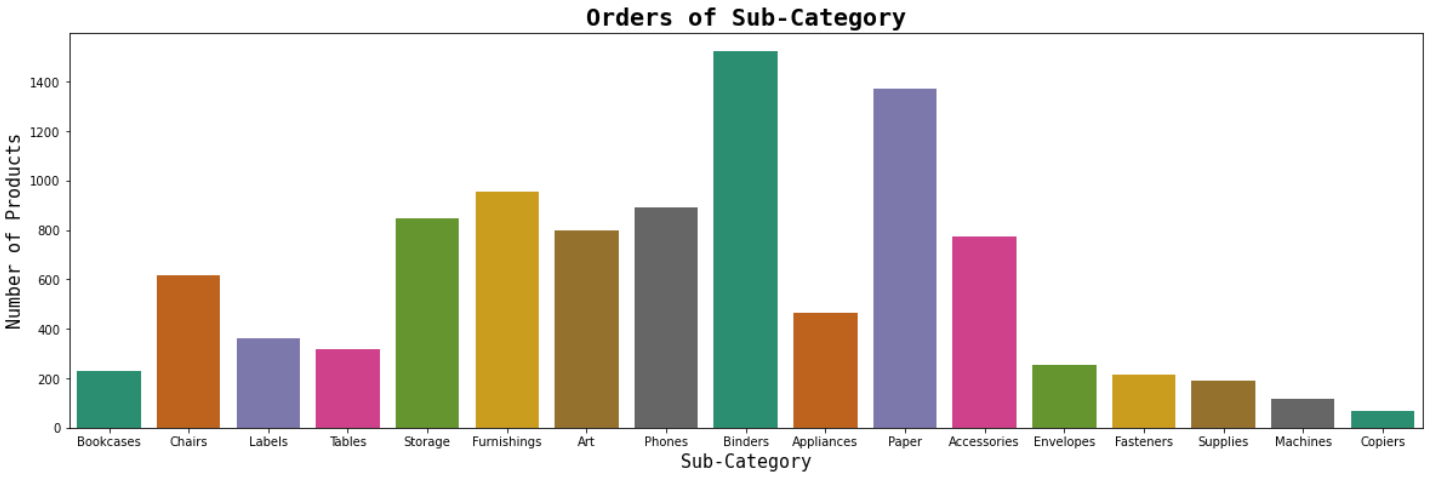
In [130]:

```
plt.figure(figsize=[20,6])
sb.countplot(data['Sub-Category'], palette = 'Dark2')
plt.title('Orders of Sub-Category', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'fontweight': 'bold'})
plt.xlabel('Sub-Category', fontdict={'fontname':'Monospace', 'fontsize': 15,})
plt.ylabel('Number of Products', fontdict={'fontname':'Monospace', 'fontsize': 15,})
```

```
c:\Users\Mannahil Miftah\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[130]:

```
Text(0, 0.5, 'Number of Products')
```

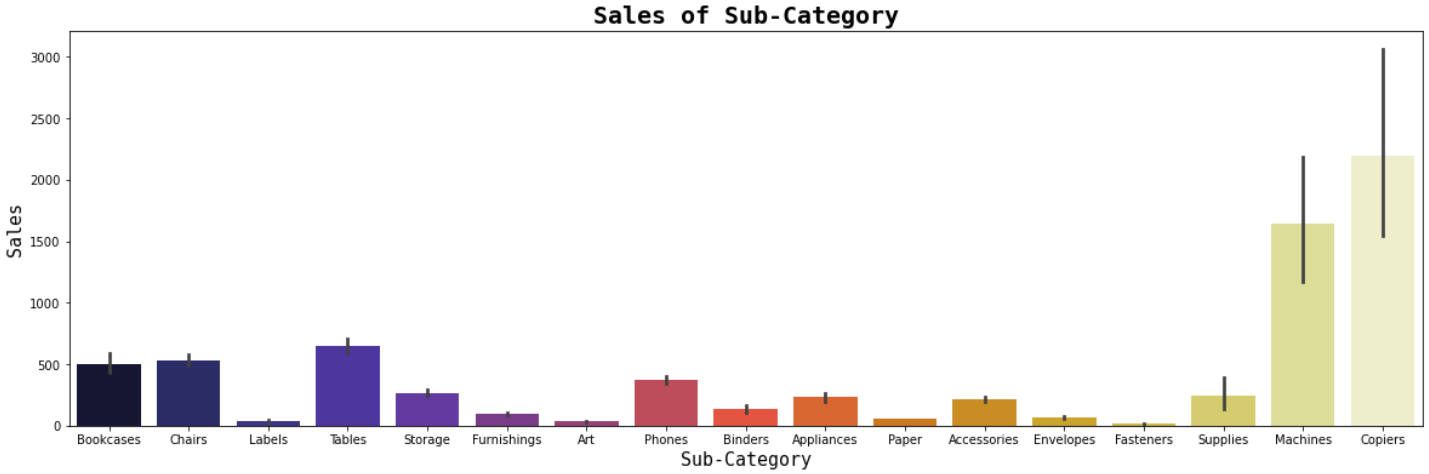


In [46]:

```
plt.figure(figsize=[20,6])
sb.barplot(data = data, x = 'Sub-Category', y = "Sales", palette = 'CMRmap')
plt.title('Sales of Sub-Category', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'fo
ntweight': 'bold'})
plt.xlabel('Sub-Category', fontdict={'fontname':'Monospace', 'fontsize': 15,})
plt.ylabel('Sales', fontdict={'fontname':'Monospace', 'fontsize': 15,})
```

Out[46]:

```
Text(0, 0.5, 'Sales')
```



Most Popular Products

In [47]:

```
popular_products = pd.DataFrame(data.groupby('Product Name')['Sales'].count())
most_popular = popular_products.sort_values('Sales', ascending=False)
most_popular = most_popular.reset_index()
most_popular.head(5)
```

Out[47]:

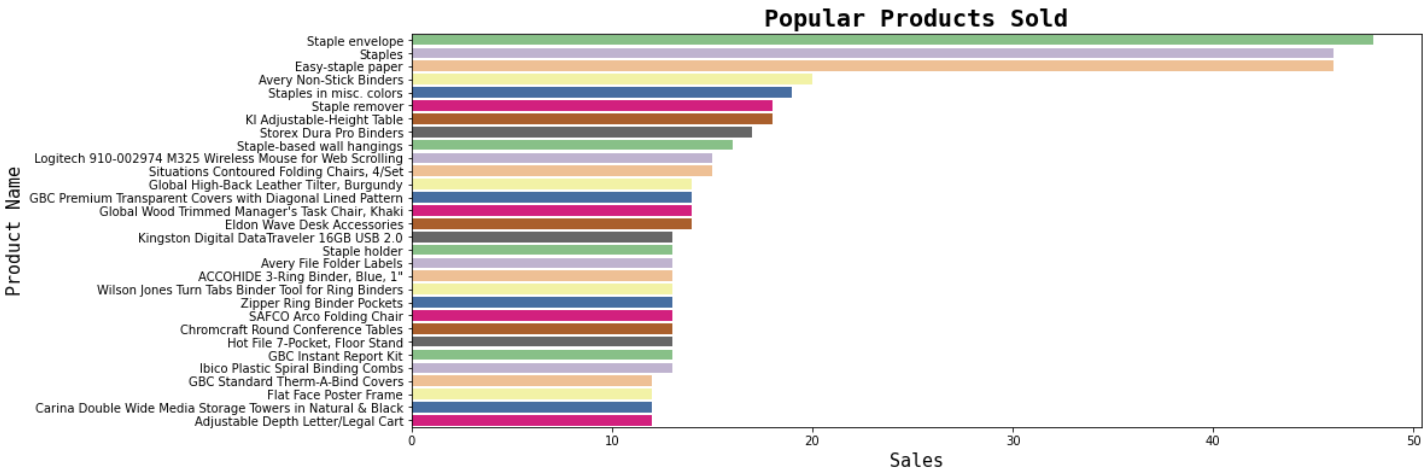
	Product Name	Sales
0	Staple envelope	48
1	Staples	46
2	Easy-staple paper	46
3	Avery Non-Stick Binders	20
4	Staples in misc. colors	19

In [48]:

```
plt.figure(figsize=[15,6])
sb.barplot(data = most_popular.head(30), x = 'Sales', y = "Product Name", palette = 'Accent')
plt.title('Popular Products Sold', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'fontweight': 'bold'})
plt.xlabel('Sales', fontdict={'fontname':'Monospace', 'fontsize': 15,})
plt.ylabel('Product Name', fontdict={'fontname':'Monospace', 'fontsize': 15,})
```

Out[48]:

```
Text(0, 0.5, 'Product Name')
```



Most Profitable City

In [78]:

```
profitable_city = pd.DataFrame(data.groupby('City')['Profit'].sum())
most_profit = profitable_city.sort_values('Profit', ascending=False)
most_profit.head(10)
```

Out[78]:

City	Profit
New York City	62036.9837
Los Angeles	30440.7579
Seattle	29156.0967
San Francisco	17507.3854
Detroit	13181.7908
Lafayette	10018.3876
Jackson	7581.6828
Atlanta	6993.6629
Minneapolis	6824.5846
San Diego	6377.1960

Most Profitable State

In [108]:

```
profitable_state = pd.DataFrame(data.groupby('State')['Profit'].sum())
most_profit = profitable_state.sort_values('Profit', ascending=False)
most_profit = most_profit.reset_index()
most_profit.head(10)
```

Out[108]:

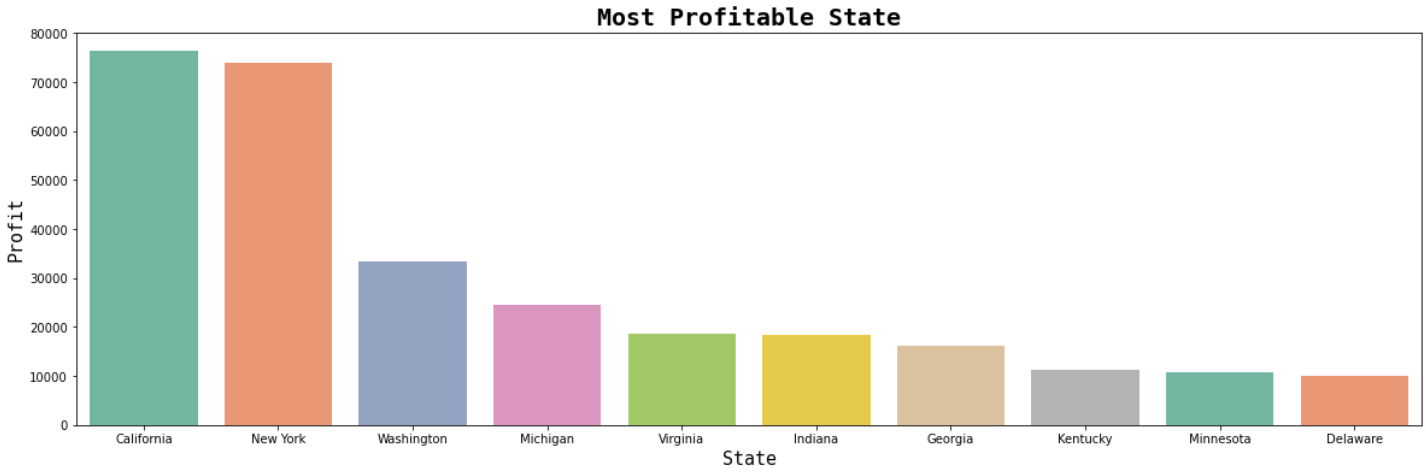
	State State	Profit Profit
0	California	76381.3871
1	New York	74038.5486
2	Washington	33402.6517
3	Michigan	24463.1876
4	Virginia	18597.9504
5	Indiana	18382.9363
6	Georgia	16250.0433
7	Kentucky	11199.6966
8	Minnesota	10823.1874
9	Delaware	9977.3748

In [135]:

```
plt.figure(figsize=[20,6])
sb.barplot(data = most_profit.head(10), x = 'State', y = 'Profit', palette = 'Set2')
plt.title('Most Profitable State', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'f
ontweight': 'bold'})
plt.xlabel('State', fontdict={'fontname':'Monospace', 'fontsize': 15,})
plt.ylabel('Profit', fontdict={'fontname':'Monospace', 'fontsize': 15,})
```

Out[135]:

```
Text(0, 0.5, 'Profit')
```



States in Loss

In [110]:

```
loss = profitable_state.sort_values('Profit', ascending=True)
loss = loss.reset_index()
loss.head(10)
```

Out[110]:

	State	Profit
0	Texas	-25729.3563
1	Ohio	-16971.3766
2	Pennsylvania	-15559.9603
3	Illinois	-12607.8870
4	North Carolina	-7490.9122
5	Colorado	-6527.8579
6	Tennessee	-5341.6936
7	Arizona	-3427.9246

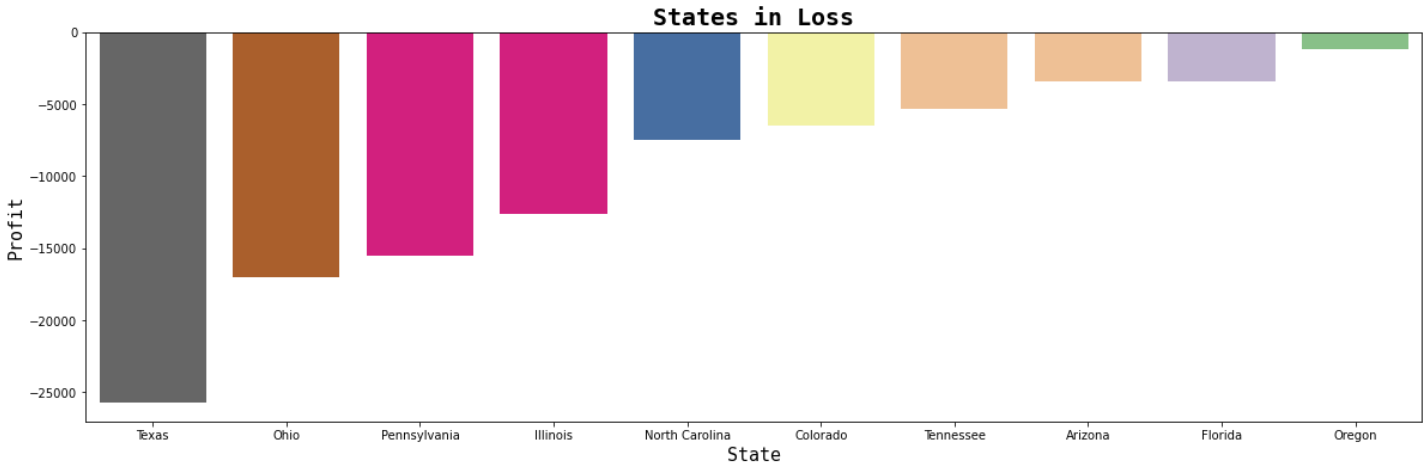
	State	Profit
8	Florida	-3399.3017
9	Oregon	-1190.4705

In [136]:

```
plt.figure(figsize=[20,6])
sb.barplot(data = loss.head(10), x = 'State', y = 'Profit', palette = 'Accent_r')
plt.title('States in Loss', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'fontweight': 'bold'})
plt.xlabel('State', fontdict={'fontname':'Monospace', 'fontsize': 15,})
plt.ylabel('Profit', fontdict={'fontname':'Monospace', 'fontsize': 15,})
```

Out[136]:

```
Text(0, 0.5, 'Profit')
```



Comparing the plots of Profit & States w.r.t States it is observed that Texas & Illinois have good sales but loss in profit

Most Profitable Segment

In [151]:

```
px.scatter(data, x='Sales', y='Profit', color='Segment', trendline='ols')
```

Most Profitable Sub-Category

In [154]:

```
px.scatter(data, x='Sales', y='Profit', color='Sub-Category', trendline='ols')
```

Regression plot of Sales & Profit

In [155]:

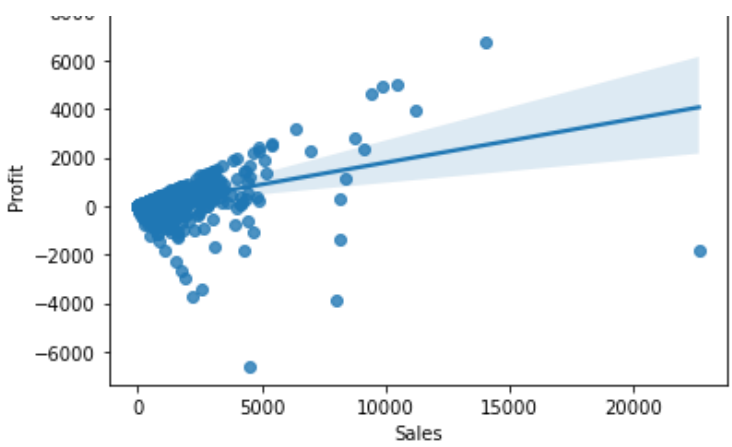
```
sb.regplot('Sales','Profit',data)
```

```
c:\Users\Mannahil Miftah\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning:

Pass the following variables as keyword args: x, y, data. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
```

Out[155]:

```
<AxesSubplot:xlabel='Sales', ylabel='Profit'>
```



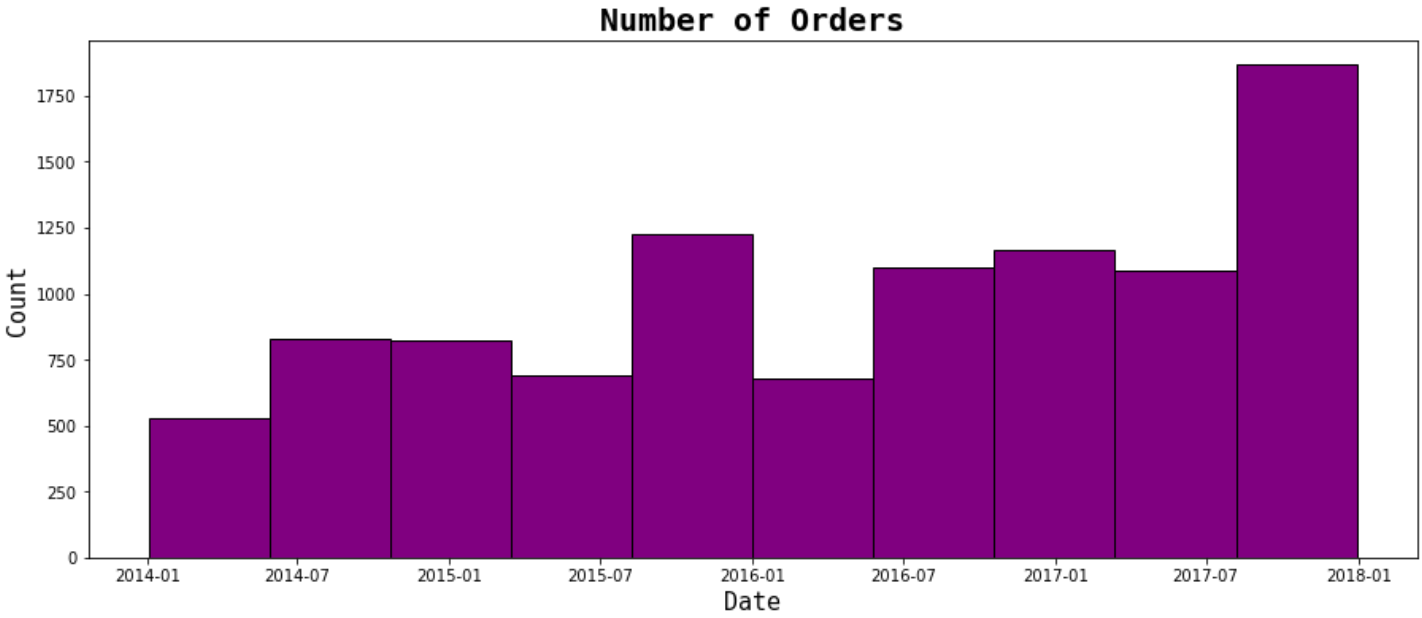
Number of Orders Placed w.r.t Date

In [157]:

```
plt.figure(figsize=[15,6])
plt.hist(data = data, x = 'Order Date', color = 'purple', ec = 'black')
plt.title('Number of Orders', fontdict={'fontname': 'Monospace', 'fontsize': 20, 'fontweight': 'bold'})
plt.xlabel('Date', fontdict={'fontname':'Monospace', 'fontsize': 15,})
plt.ylabel('Count', fontdict={'fontname':'Monospace', 'fontsize': 15,})
```

Out[157]:

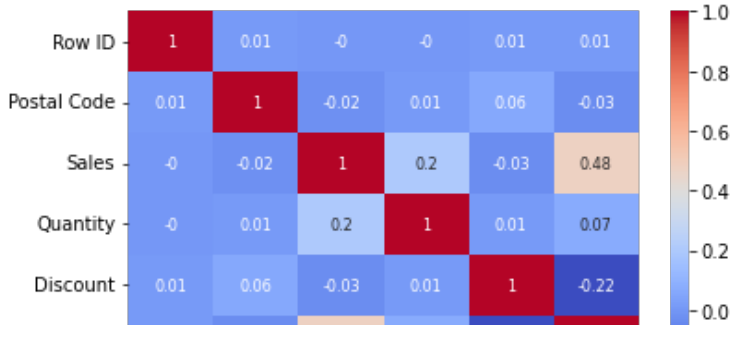
```
Text(0, 0.5, 'Count')
```

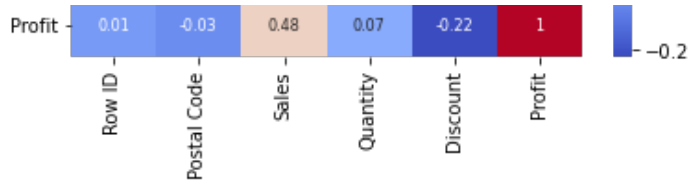


Heatmap

In [131]:

```
sb.heatmap(data=data.corr().round(2), cmap='coolwarm', annot=True, annot_kws={"size":8})
plt.tight_layout()
plt.show()
```





Pre Processing data to be applied on any ML algo

In [54]:

```
data1 = data.copy()
```

In [63]:

```
data1 = data1.apply(LabelEncoder().fit_transform)
data1
```

Out[63]:

	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	State	Postal Code	Region	Product ID	Category	C
0	2500	864	929	2	143	166	0	0	194	15	217	2	12	0	
1	2500	864	929	2	143	166	0	0	194	15	217	2	55	0	
2	2296	732	787	2	237	201	1	0	266	3	517	3	946	1	
3	4372	519	568	3	705	687	0	0	153	8	170	2	319	0	
4	4372	519	568	3	705	687	0	0	153	8	170	2	1316	1	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9989	138	15	12	2	737	758	0	0	295	8	169	2	200	0	
9990	3216	956	1033	3	190	202	0	0	104	3	555	3	164	0	
9991	3216	956	1033	3	190	202	0	0	104	3	555	3	1816	2	
9992	3216	956	1033	3	190	202	0	0	104	3	555	3	1247	1	
9993	3194	1016	1096	2	130	146	0	0	517	3	560	3	433	1	

9994 rows × 20 columns

In [158]:

```
sales = data1['Sales']
```

In [159]:

```
scaler = StandardScaler().fit(data1.drop('Sales', axis = 1))
features = scaler.transform(data1.drop('Sales', axis = 1))
```

In [160]:

```
X_train, X_test, y_train, y_test = train_test_split(features, sales, test_size = 0.1)
```

Data is PROCESSED now and is READY

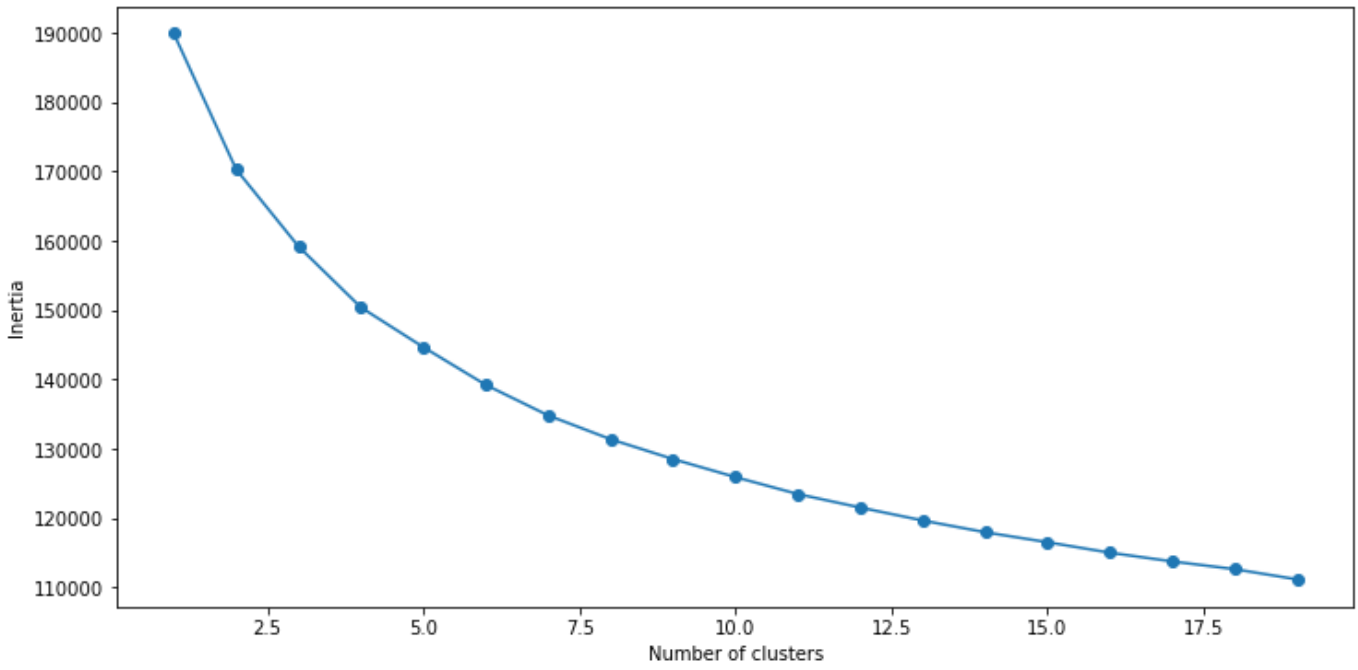
In [161]:

```
scaler = StandardScaler()
data_scaled = scaler.fit_transform(data1)
pd.DataFrame(data_scaled)
kmeans = KMeans(n_clusters=2, init='k-means++')
kmeans.fit(data_scaled)
SSE = []
```

```
for cluster in range(1,20):
    kmeans = KMeans(n_clusters = cluster, init='k-means++')
    kmeans.fit(data_scaled)
    SSE.append(kmeans.inertia_)
frame = pd.DataFrame({'Cluster':range(1,20), 'SSE':SSE})
plt.figure(figsize=(12,6))
plt.plot(frame['Cluster'], frame['SSE'], marker='o')
plt.xlabel('Number of clusters')
plt.ylabel('Inertia')
```

Out[161]:

```
Text(0, 0.5, 'Inertia')
```



In [162]:

```
kmeans = KMeans(n_clusters = 7, init='k-means++')
kmeans.fit(data_scaled)
pred = kmeans.predict(data_scaled)
frame = pd.DataFrame(data_scaled)
frame['cluster'] = pred
frame['cluster'].value_counts()
```

Out[162]:

```
5    1751
4    1712
1    1661
3    1439
6    1312
0    1238
2     881
Name: cluster, dtype: int64
```

In [ ]:

```

```