Exploratory Data Analysis - Retail

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0.1 Task3-Exploratory Data Analysis - Retail

0.1.1 objectives

As a business manager, try to find out the weak areas where you can work to make more profit. What all business problems you can derive by exploring the data?

Step 1 - import librires

[ ]:
```
import pandas as pd
import numpy as np
import seaborn as sns
from matplotlib import pyplot as plt
```

Step 2 - Reading the data from source

[ ]:
```
# url="https://bit.ly/3i4rbWl"
data=pd.read_csv("SampleSuperstore.csv")
data.head()
```

[ ]:

	Ship Mode	Segment	Country	City	State	Postal Code	Region	Category	Sub-Category	Sales	Quantity	Discount	Profit
0	Second Class	Consumer	United States	Henderson	Kentucky	42420	South	Furniture	Bookcases	261.9600	2	0.00	41.9136
1	Second Class	Consumer	United States	Henderson	Kentucky	42420	South	Furniture	Chairs	731.9400	3	0.00	219.5820
2	Second Class	Corporate	United States	Los Angeles	California	90036	West	Office Supplies	Labels	14.6200	2	0.00	6.8714
3	Standard Class	Consumer	United States	Fort Lauderdale	Florida	33311	South	Furniture	Tables	957.5775	5	0.45	-383.0310
4	Standard Class	Consumer	United States	Fort Lauderdale	Florida	33311	South	Office Supplies	Storage	22.3680	2		

```
4      0.20    2.5164
```

Step 3 - Explore Data

[ ]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9994 entries, 0 to 9993
Data columns (total 13 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   Ship Mode     9994 non-null   object
 1   Segment       9994 non-null   object
 2   Country       9994 non-null   object
 3   City          9994 non-null   object
 4   State         9994 non-null   object
 5   Postal Code   9994 non-null   int64
 6   Region        9994 non-null   object
 7   Category      9994 non-null   object
 8   Sub-Category  9994 non-null   object
 9   Sales         9994 non-null   float64
 10  Quantity      9994 non-null   int64
 11  Discount      9994 non-null   float64
 12  Profit        9994 non-null   float64
dtypes: float64(3), int64(2), object(8)
memory usage: 1015.1+ KB
```

[ ]:
```
data.shape
```

[ ]:
```
(9994, 13)
```

[ ]:
```
data.describe()
```

[ ]:

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

[ ]:
```
data=data.drop(columns=['Postal Code'],axis=1)
```

[ ]:
```
data.duplicated().sum()
```

[ ]:
```
50
```

[ ]:
```
data.drop_duplicates(subset=None,keep='first',inplace=True)
data.duplicated().sum()
```

[ ]:
```
0
```

[ ]:
```
data.select_dtypes(include='object').nunique()
```

[ ]:
```
Ship Mode         4
Segment           3
Country           1
City            531
State            49
Region            4
Category          3
Sub-Category     17
dtype: int64
```

[ ]:
```
data.Country.unique()
```

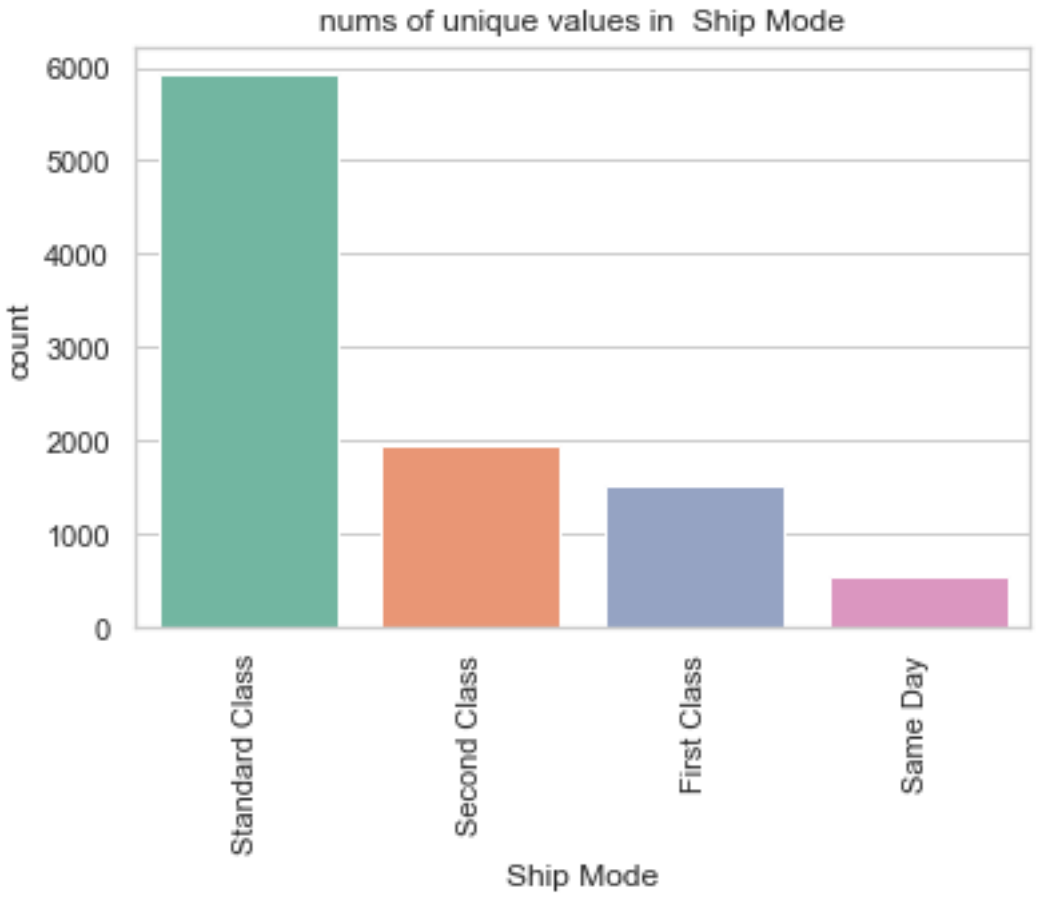
[ ]:
```
array(['United States'], dtype=object)
```

here we have only 1 Country United States .

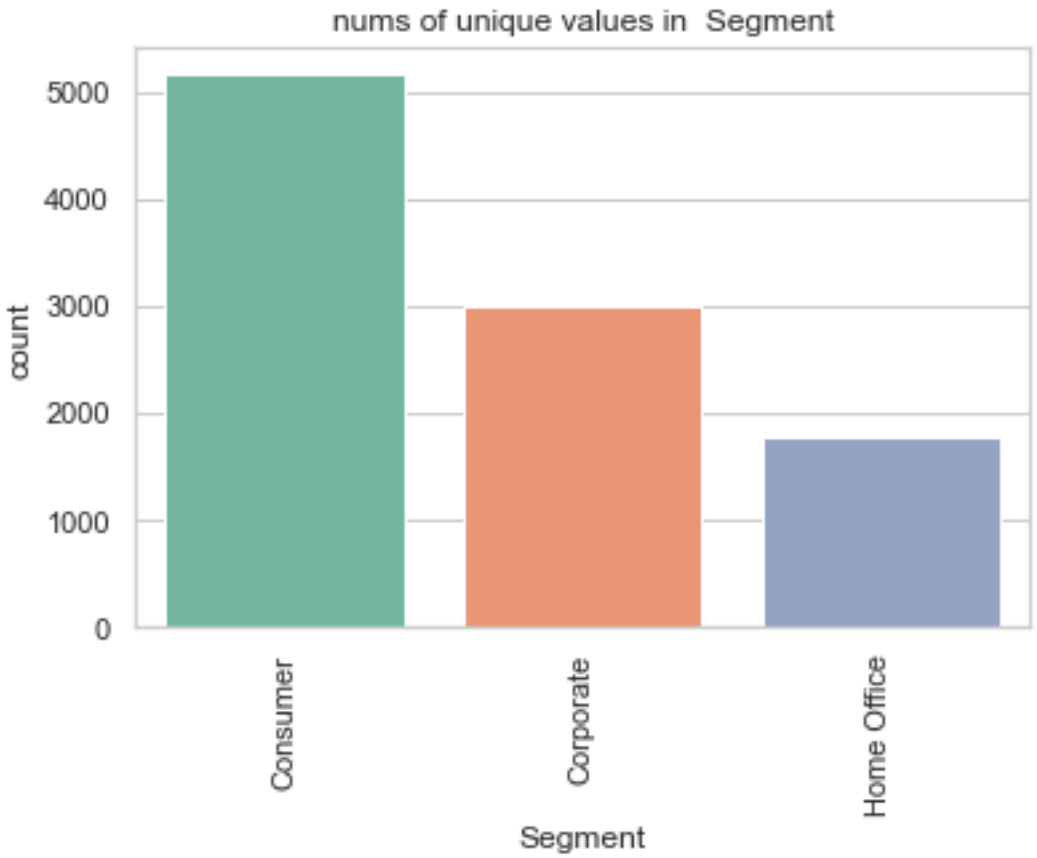
distribution of Ship Mode, Segment , Category, Sub-Category

[ ]:
```
data_object=data[['Ship Mode', 'Segment',
       'Category', 'Sub-Category']]
def object_col_with_chart(data):
    for col in data.columns:
        plt.Figure(figsize=(10,8))
        print(f"{col} Column")
        print(""*50)

        # print(data[col].value_counts().sort_values(ascending=False))
        sns.countplot(x=data[col],palette = "Set2",order=data[col].
 ↪value_counts().sort_values(ascending=False).index)
        plt.xticks(rotation=90)
        plt.title(f"nums of unique values in  {col}")
        plt.show()
        print(f"****OBSERVATION****")
        print(f"We have {data[col].nunique()} unique values in {col}")
        print(f"The highest is  {data[col].value_counts().index[0]} and the␣
 ↪lowest is {data[col].value_counts().index[-1]} ")
        print("*"*50)

object_col_with_chart(data_object)
```

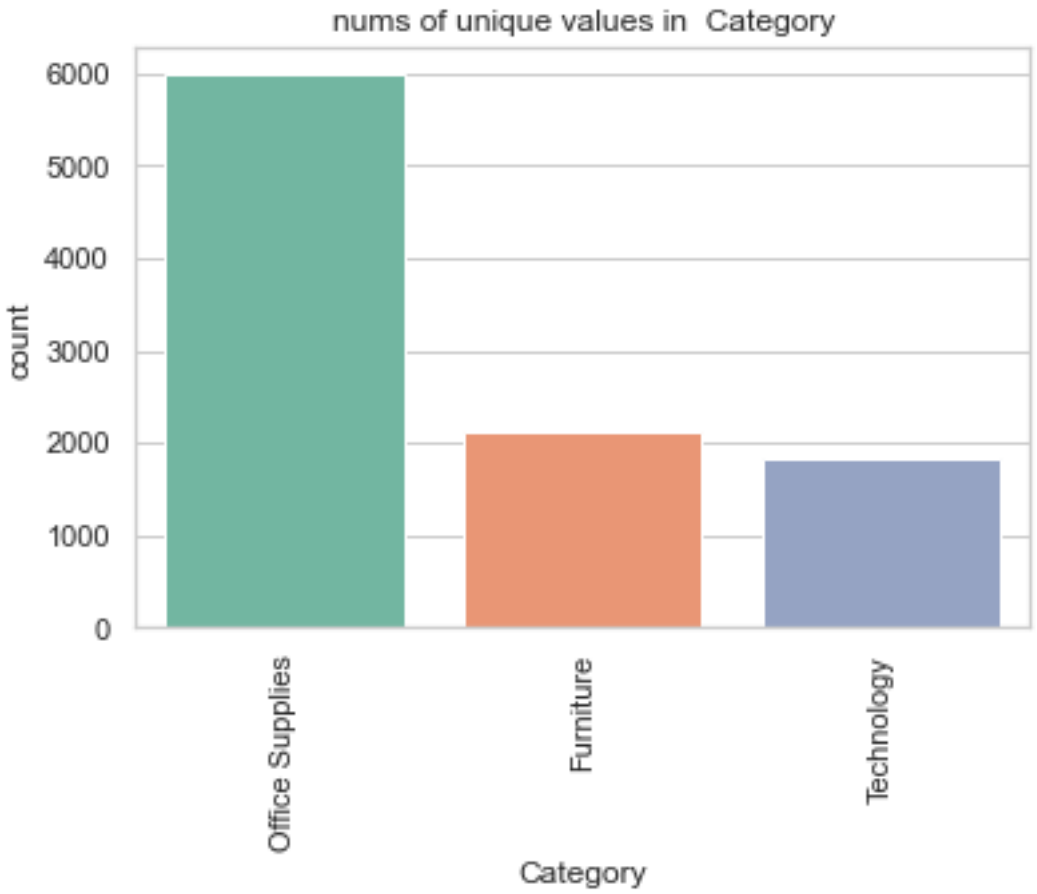
```
Ship Mode Column
```



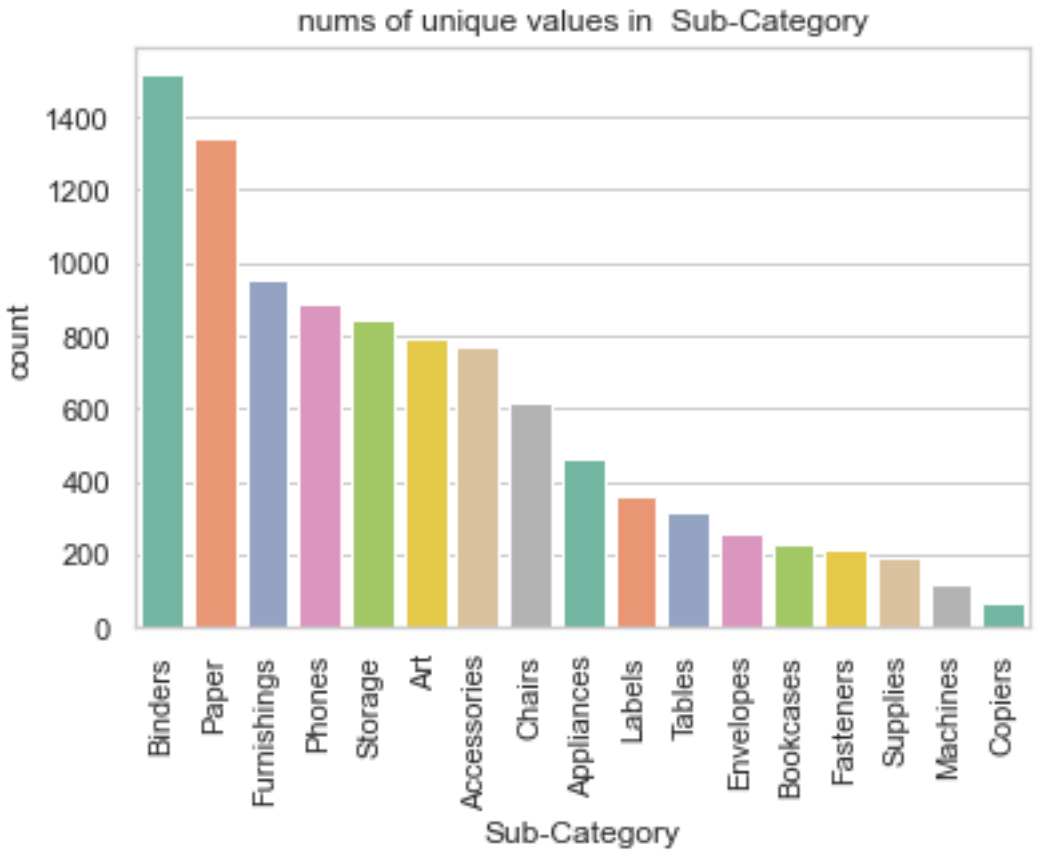

```
****OBSERVATION****
We have 4 unique values in Ship Mode
The highest is  Standard Class and the lowest is Same Day
**********************************************
Segment Column
```




```
****OBSERVATION****
We have 3 unique values in Segment
The highest is  Consumer and the lowest is Home Office
**********************************************
Category Column
```



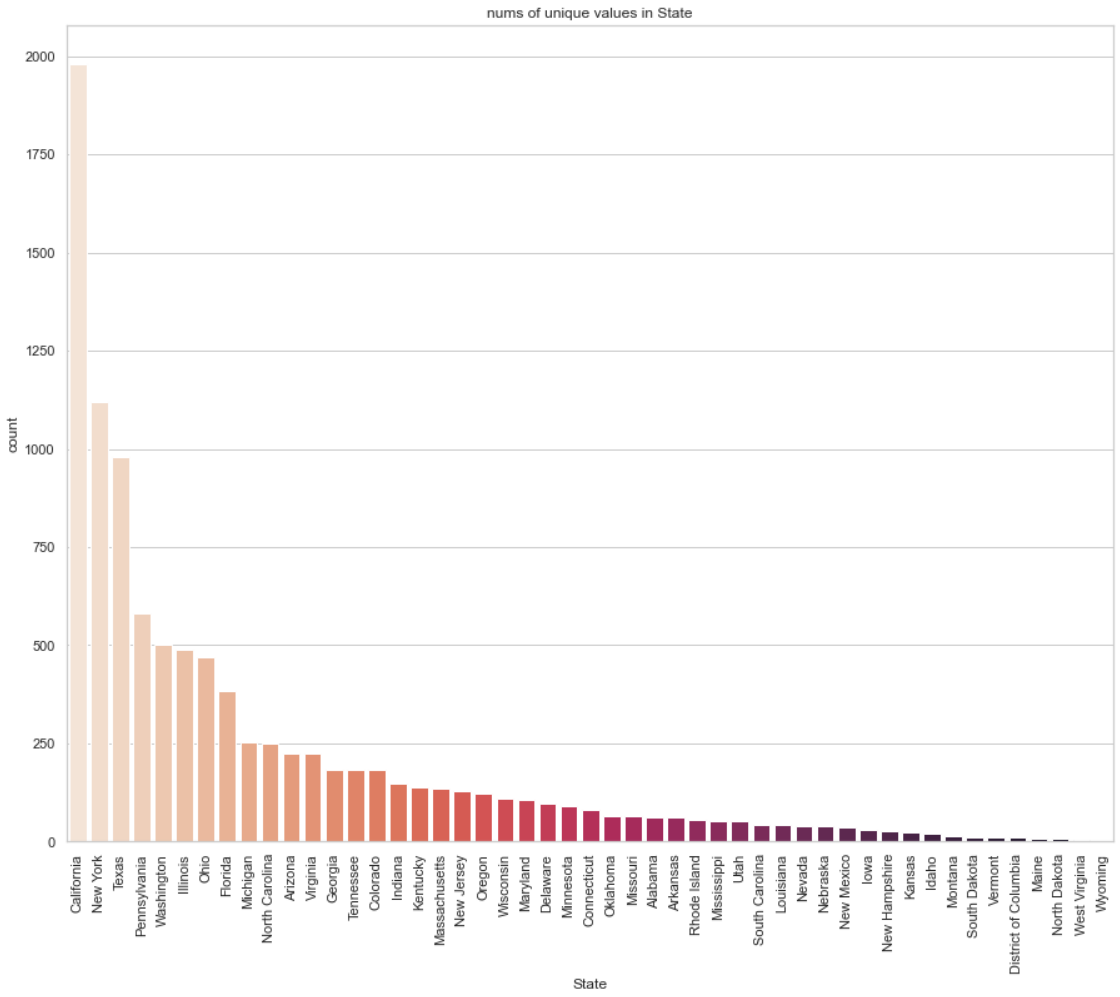

```
****OBSERVATION****
We have 3 unique values in Category
The highest is  Office Supplies and the lowest is Technology
**********************************************
Sub-Category Column
```




```
****OBSERVATION****
We have 17 unique values in Sub-Category
The highest is  Binders and the lowest is Copiers
**************************************************
```

state distribution

[ ]:
```
plt.figure(figsize=(15,12))
sns.countplot(x=data['State'],palette = "rocket_r",order=data['State'].
 ↪value_counts().sort_values(ascending=False).index)
plt.xticks(rotation=90)
plt.title(f"nums of unique values in State")
plt.show()
print(f"****OBSERVATION****")
print(f"We have {data['State'].nunique()} unique values in State")
print(f"The highest is  {data['State'].value_counts().index[0]} and the lowest␣
 ↪is {data['State'].value_counts().index[-1]} ")
```



****OBSERVATION****
We have 49 unique values in State
The highest is California and the lowest is Wyoming

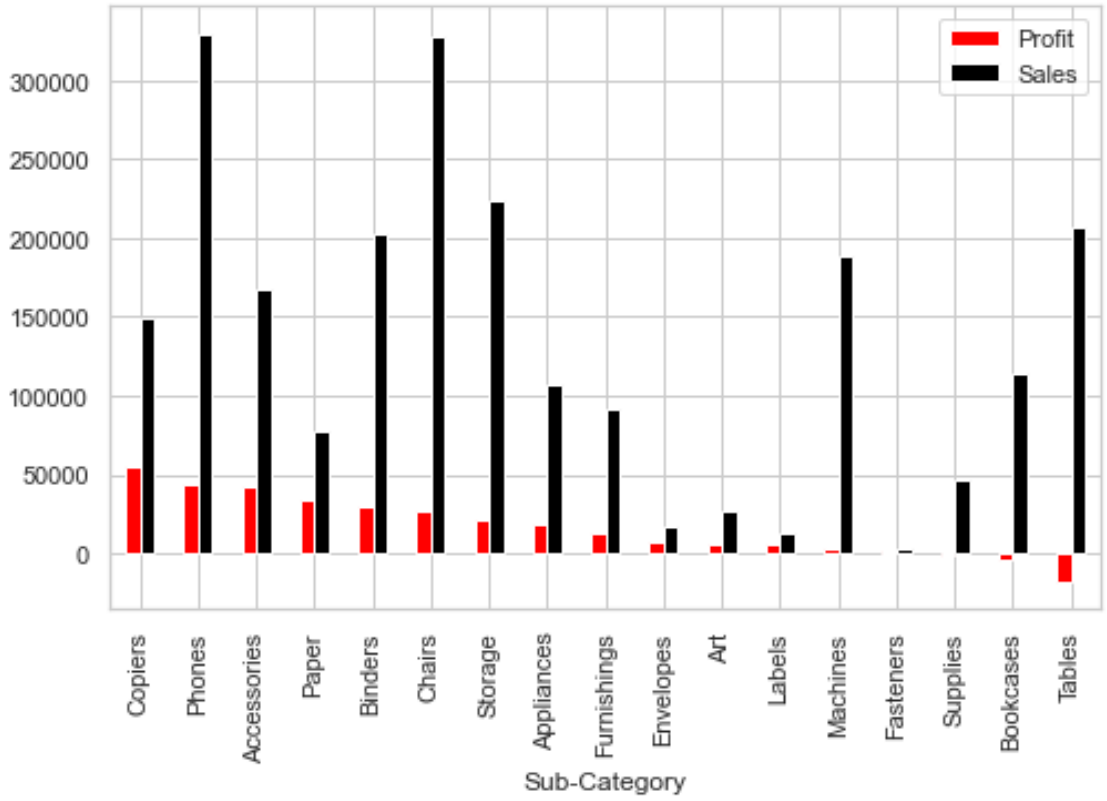
Profit and Sales in Sub-Category

[ ]:
```
data_profit_per_sub_category=data[['Sub-Category','Profit','Sales","Category"]].
 ↪groupby("Sub-Category")["Profit","Sales"].sum().
 ↪sort_values(by="Profit",ascending=False).plot(kind='bar', color=['red',␣
 ↪'black'],figsize=(8,5));
data_profit_per_sub_category
```

c:\Users\NOUR\AppData\Local\Programs\Python\Python36\lib\site-packages\ipykernel_launcher.py:1: FutureWarning:

Indexing with multiple keys (implicitly converted to a tuple of keys) will be deprecated, use a list instead.

[ ]: <AxesSubplot:xlabel='Sub-Category'>

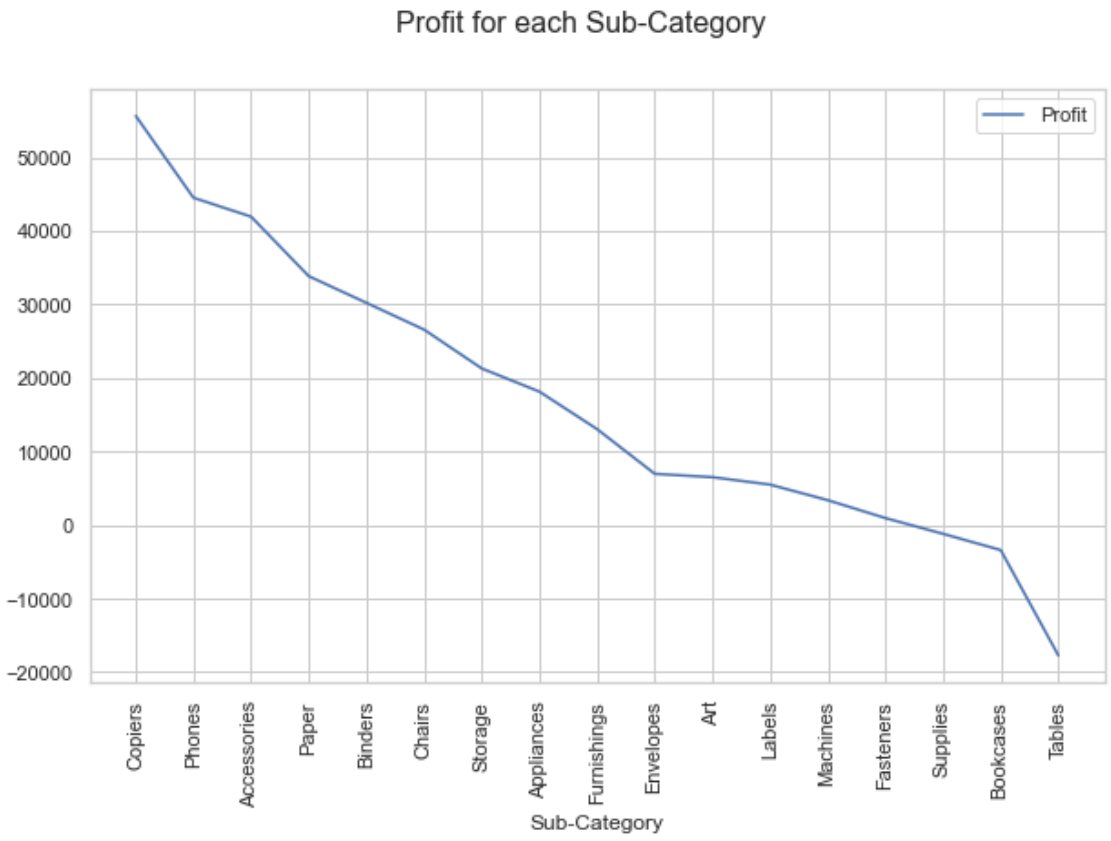


observation The HIGHEST Sub-Category profit is Copiers , Phones , Accessories , and the LOWEST Sub-Category profit is Tabels , Bookcases , Supplies

[ ]:
```
#if we want to plot it as line
data_profit_per_sub_category=data[['Sub-Category','Profit','Sales']].
 ↪groupby("Sub-Category")["Profit","Sales"].sum().
 ↪sort_values(by="Profit",ascending=False)
sns.set(style="whitegrid")
plt.figure(2, figsize=(10,6))
sns.lineplot(x='Sub-Category',y='Profit', data=data_profit_per_sub_category,␣
 ↪palette='BuGn',markers =True,label="Profit")
# sns.lineplot(x='Sub-Category',y='Sales', data=data_profit_per_sub_category,␣
 ↪palette='Oranges',markers =True,label="Sales")

plt.xticks(rotation=90)
plt.ylabel("")
plt.suptitle('Profit for each Sub-Category', fontsize=16)
plt.show()
```

```
c:\Users\NOUR\AppData\Local\Programs\Python\Python36\lib\site-
```

```
packages\ipykernel_launcher.py:2: FutureWarning:

Indexing with multiple keys (implicitly converted to a tuple of keys) will be
deprecated, use a list instead.
```



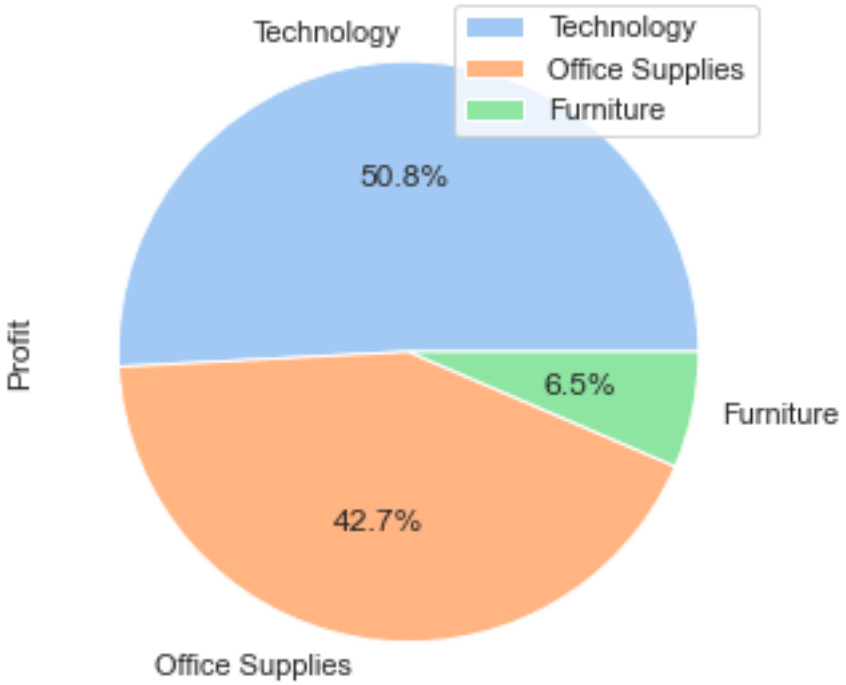
Profit for Category, Ship mode , Region ,Segment

[ ]:
```
colors = sns.color_palette('pastel')[0:5]
```

[ ]:
```
data_profit_per_category=data[['Category','Profit']].
 ↪groupby("Category")["Profit"].sum().reset_index().
 ↪sort_values(by="Profit",ascending=False)
```

[ ]:
```
data_profit_per_category.plot.
 ↪pie(y='Profit',labels=data_profit_per_category['Category'],normalize=True,autopct='%1.
 ↪1f%%', colors = colors,figsize=(11,5))
plt.legend(loc="upper right")
```

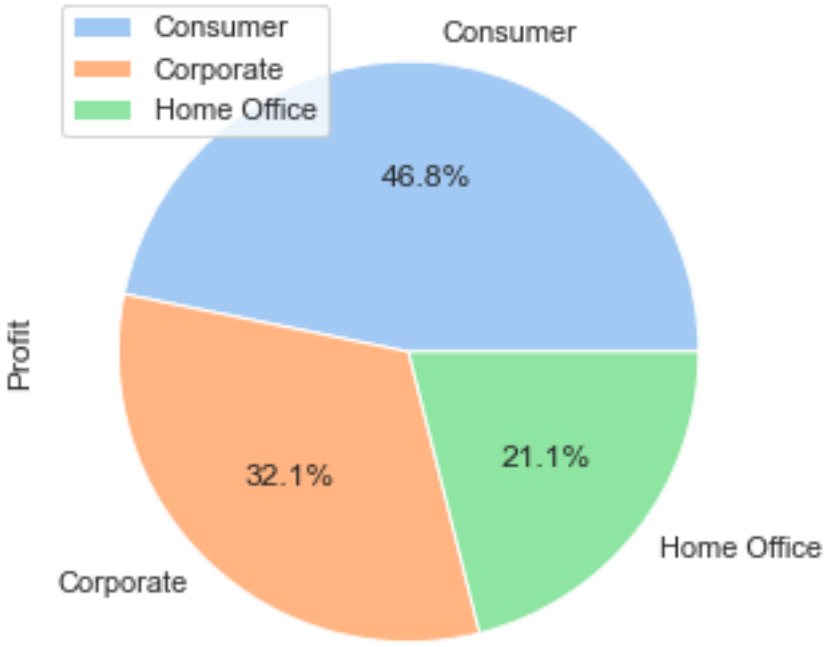
[ ]:
```
<matplotlib.legend.Legend at 0x241b087d668>
```



observation Technology Category is The HIGHEST profit and Furniture is the LOWEST

[ ]:
```
data_Segment=data[['Segment','Profit']].groupby("Segment")["Profit"].sum().
↪reset_index().sort_values(by="Profit",ascending=False).plot.
↪pie(y='Profit',labels=data_Segment['Segment'],normalize=True,autopct='%1.
↪1f%%', colors = colors,figsize=(11,5))
plt.legend(loc="upper left")
```

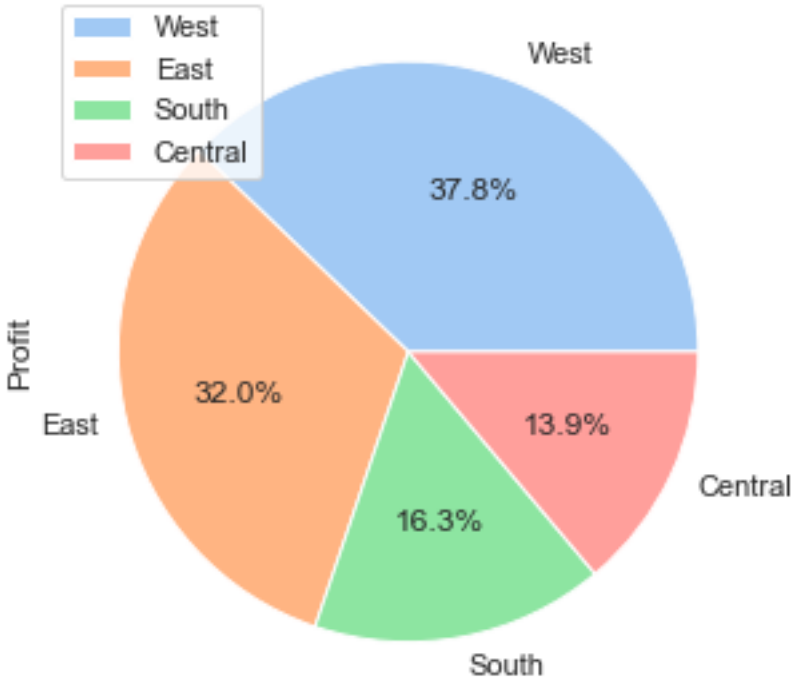
[ ]:
```
<matplotlib.legend.Legend at 0x241b04f9710>
```



observation Consumer Segment is The HIGHEST profit and Home office is the LOWEST

[ ]:
```
data_Region=data[['Region','Profit']].groupby("Region")["Profit"].sum().
↪reset_index().sort_values(by="Profit",ascending=False).plot.
↪pie(y='Profit',labels=data_Region['Region'],normalize=True,autopct='%1.
↪1f%%', colors = colors,figsize=(11,5))
plt.legend(loc="upper left")
```

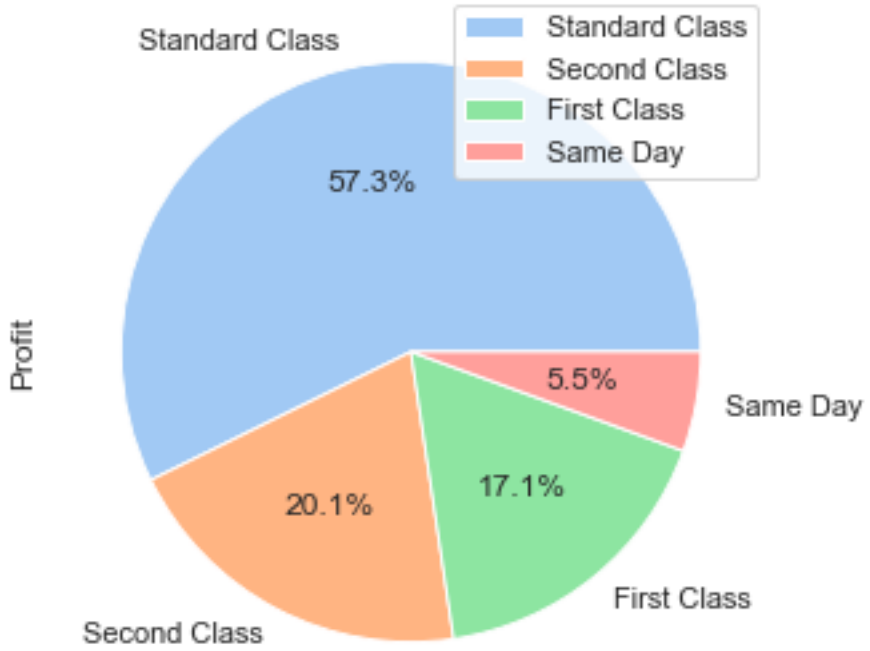
[ ]:
```
<matplotlib.legend.Legend at 0x241b20f3908>
```



observation West region is The HIGHEST profit and south is the LOWEST

[ ]:
```
data_Ship=data[['Ship Mode','Profit']].groupby('Ship Mode')["Profit"].sum().
↪reset_index().sort_values(by="Profit",ascending=False).plot.
↪pie(y='Profit',labels=data_Ship['Ship Mode'],normalize=True,autopct='%1.
↪1f%%', colors = colors,figsize=(11,5))
plt.legend(loc="upper right")
```

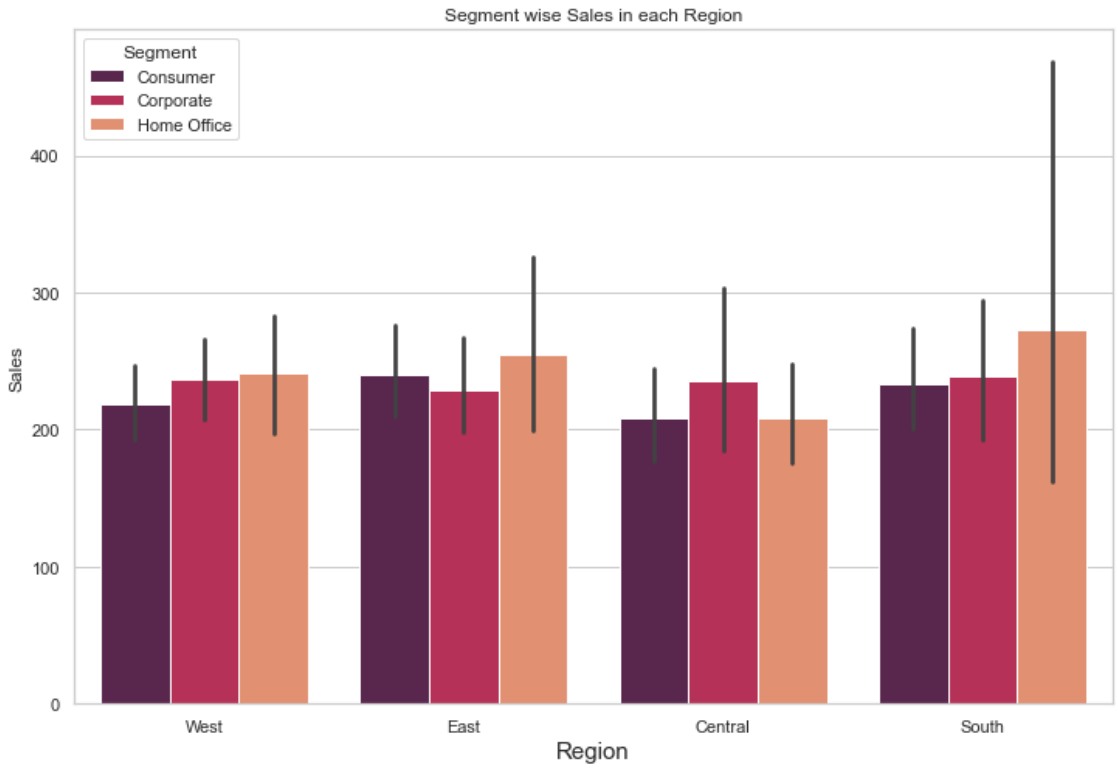
[ ]:
```
<matplotlib.legend.Legend at 0x241b0ee0eb8>
```



observation Standard Class Ship mode is The HIGHEST profit and same Day is the LOWEST

Segment wise Sales in each Region

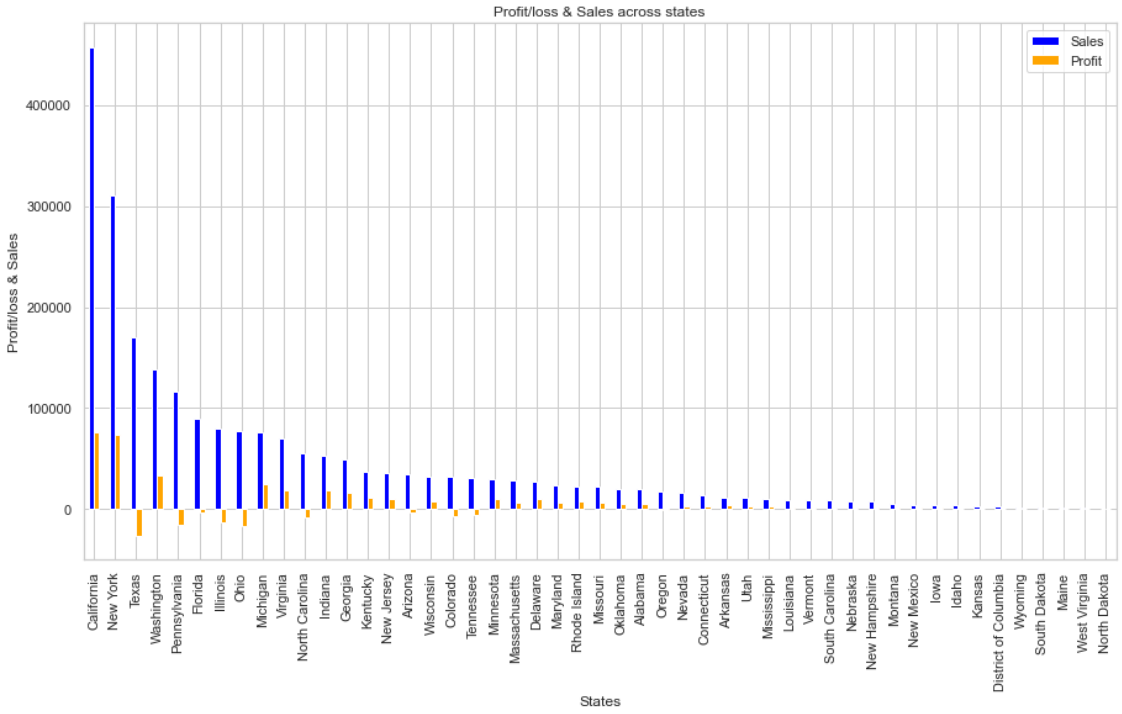
[ ]:
```
plt.figure(figsize=(12,8))
plt.title('Segment wise Sales in each Region')
sns.barplot(x='Region',y='Sales',data=data,hue='Segment',order=data['Region'].
 ↪value_counts().index,palette='rocket')
plt.xlabel('Region',fontsize=15)
plt.show()
```



Observation Segment wise sales are almost same in every region

Sales and profit in each state

[ ]:
```
ps = data.groupby('State')[['Sales','Profit']].sum().
 ↪sort_values(by='Sales',ascending=False)
ps[:].plot.bar(color=['blue','orange'],figsize=(15,8))
plt.title('Profit/loss & Sales across states')
plt.xlabel('States')
plt.ylabel('Profit/loss & Sales')
plt.show()
```



observation THe HIGHEST states are California ans Newyork ,the LOWEST is for texas, pennsylvania, Ohio

[ ]:
```
data.nsmallest(10, 'Profit')
```

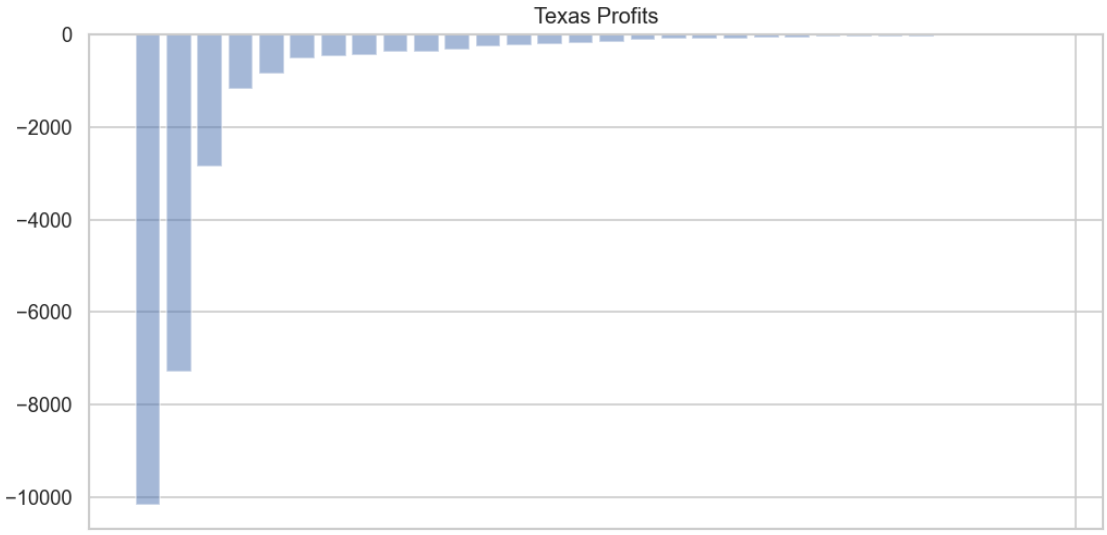
[ ]:

	Ship Mode	Segment	Country	City	State	Region	Category	Sub-Category	Sales
7772	Standard Class	Consumer	United States	Lancaster	Ohio	East	Technology	Machines	4499.985
683	Same Day	Corporate	United States	Burlington	North Carolina	South	Technology	Machines	7999.980
9774	Standard Class	Consumer	United States	San Antonio	Texas	Central	Office Supplies	Binders	2177.584
3011	Standard Class	Home Office	United States	Louisville	Colorado	West	Technology	Machines	2549.985
4991	Standard Class	Corporate	United States	Chicago	Illinois	Central	Office Supplies	Binders	1889.990
3151	First Class	Consumer	United States	Newark	Ohio	East	Technology	Machines	1799.994
5310	First Class	Consumer	United States	Houston	Texas	Central	Technology	Machines	1749.950
9639	Second Class	Consumer	United States	Concord	North Carolina	South	Technology	Machines	1399.986
1199	Standard Class	Consumer	United States	Houston	Texas	Central	Technology	Machines	1399.986
2697	Standard Class	Home Office	United States	Jacksonville	Florida	South	Technology	Machines	1259.985

```
5310           Texas  Central  Office Supplies      Binders   1525.188
9639  North Carolina    South        Furniture       Tables   4297.644
1199           Texas  Central  Office Supplies      Binders   1088.792
2697         Florida    South       Technology     Machines  22638.480

      Quantity  Discount     Profit
7772         5       0.7 -6599.9780
683          4       0.5 -3839.9904
9774         8       0.8 -3701.8928
3011         5       0.7 -3399.9800
4991         5       0.8 -2929.4845
3151         2       0.7 -2639.9912
5310         6       0.8 -2287.7820
9639        13       0.4 -1862.3124
1199         4       0.8 -1850.9464
2697         6       0.5 -1811.0784
```

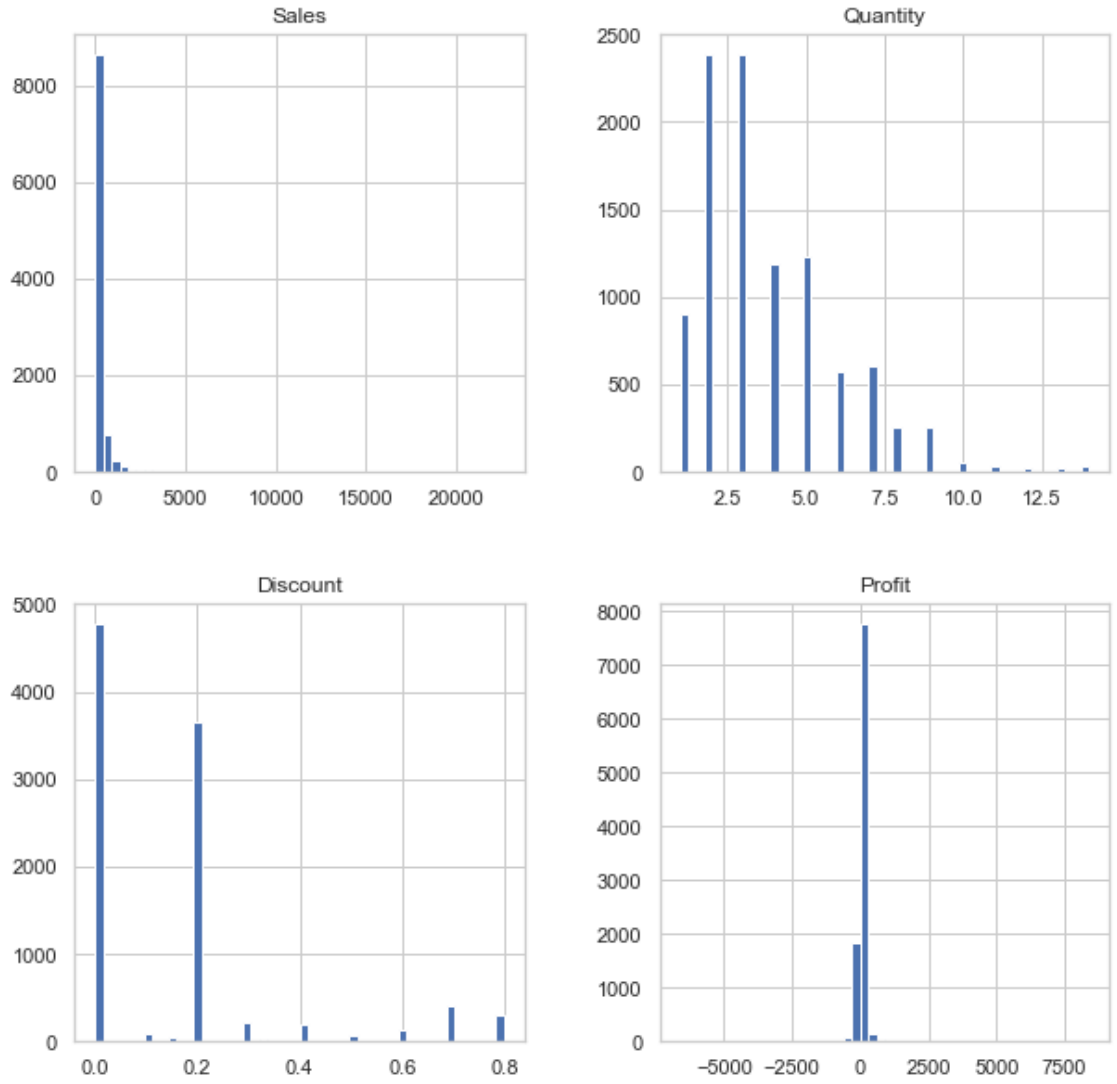
observations - The lowest profit (-6599.978) is at `Ohio` state in `Lanacaster` city at `Machines` - The profit is negative and that means production costs are more than your total revenue for a specific period - I think the reason is the Discount amout as it is 40% and above and it can get to 80% so it need to be less - most of them in Texas state

[ ]:
```
plt.figure(figsize=(10,5), dpi = 120)
z=data[data['State']=='Texas'].groupby('City')['Profit'].sum().sort_values()[:
↪30]
plt.bar(z.index,z.values, align='center', alpha=0.5,)
plt.xticks('');
plt.title('Texas Profits');
```



observation Most of Texas cities has the Negative Profit !!

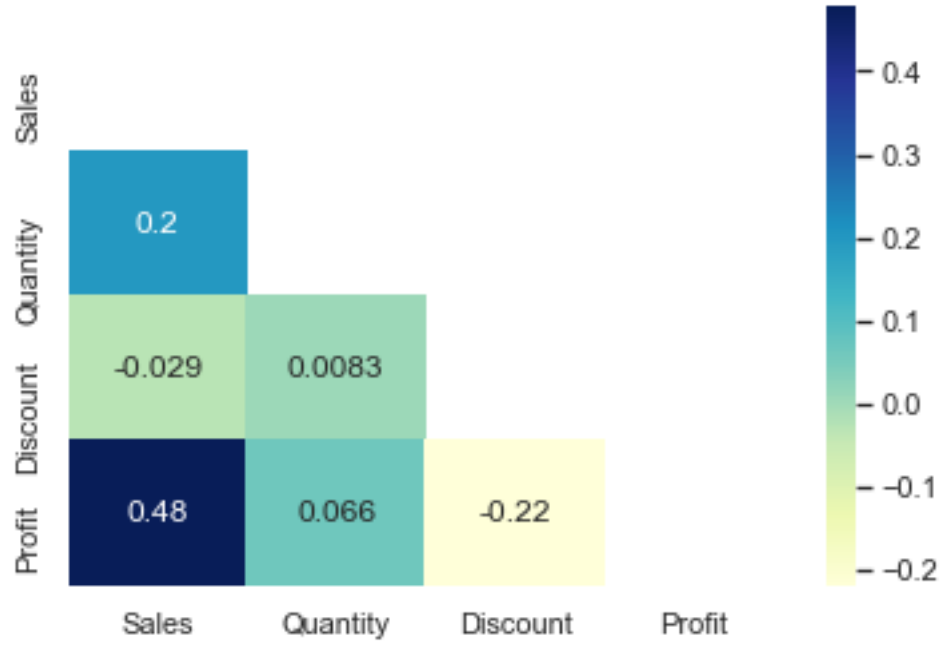
[ ]:
```
data.hist(figsize=(10,10),bins=50)
plt.show()
```



Observation Most customers tends to buy quantity of 2 and 3 Discount give maximum is 0 to 20 percent

Correlation

[ ]:
```
mask = np.triu(np.ones_like(data.corr()))
dataplot = sns.heatmap(data.corr(), cmap="YlGnBu", annot=True, mask=mask)
```



sales vs profit

[ ]:
```
plt.scatter(x='Sales',y='Profit',data=data)
plt.xlabel("Sales")
plt.ylabel("Profit")
plt.title("Sales vs profit");
```

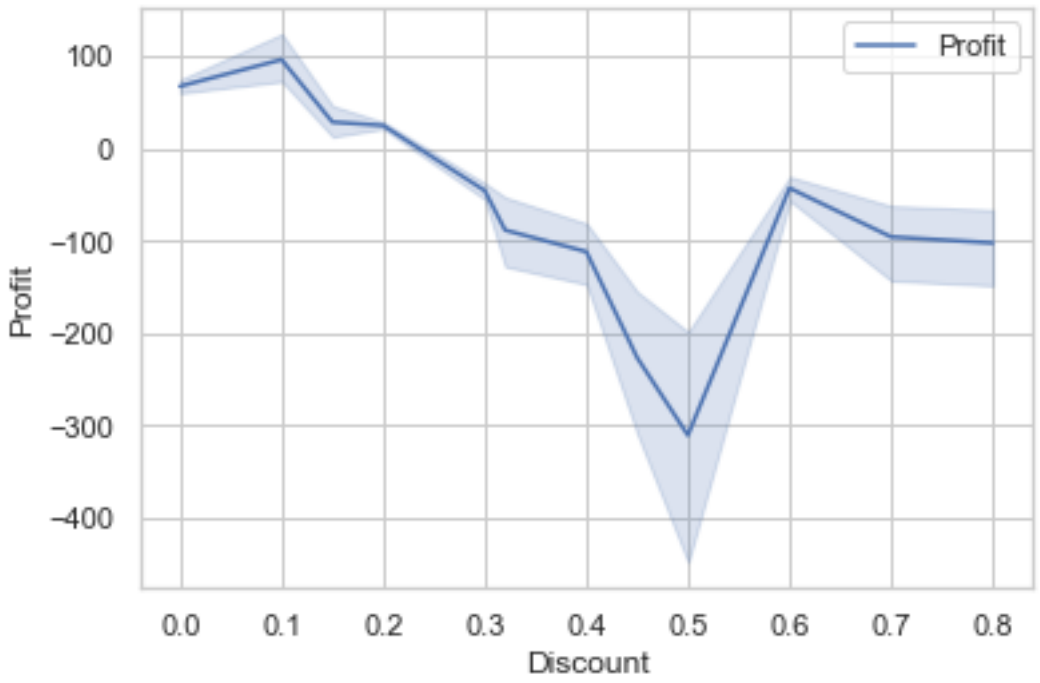
[ ]:
```
data.corr()["Sales"]["Profit"]
```

[ ]:
```
0.4790776384603207
```

there is (0.47) positive correlation between profit and sales

profit vs Discount

[ ]:
```
sns.lineplot(x='Discount',y='Profit',label='Profit',data=data)
plt.legend()
plt.show()
```



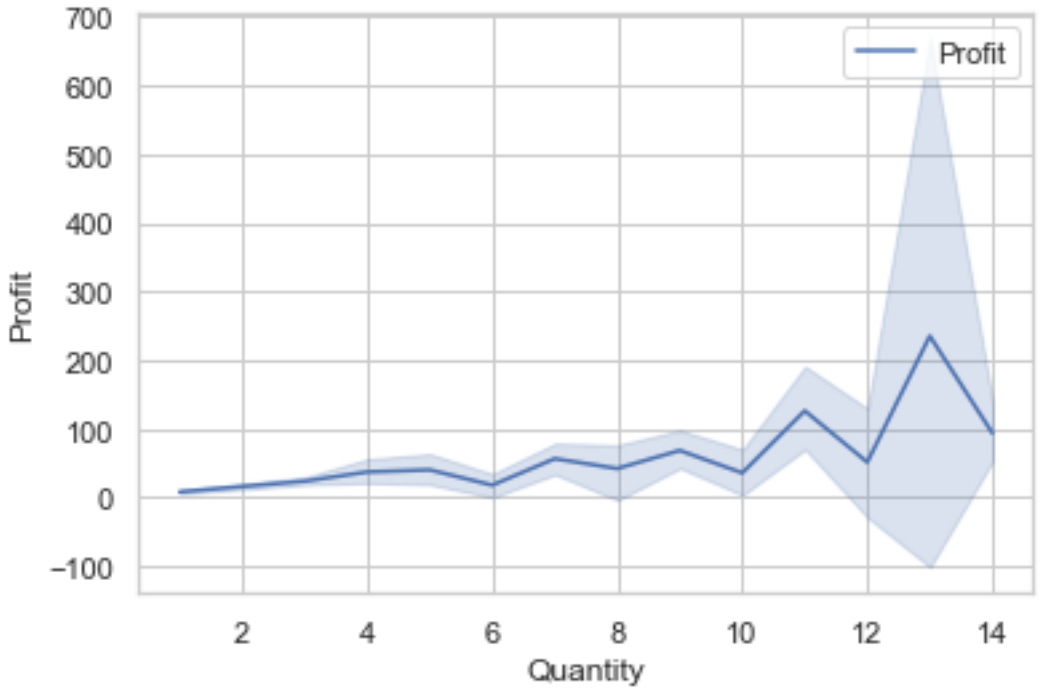
No correlation between profit and discount and it tend to be low negative correlation

[ ]:
```
data.corr()["Profit"]["Discount"]
```

[ ]:
```
-0.21993898249763688
```

profit vs Quantity

[ ]:
```
sns.lineplot(x='Quantity',y='Profit',label='Profit',data=data)
plt.legend()
plt.show()
```



[ ]:
```
df_non_profit=data.loc[data["Profit"]<0]
df_non_profit.shape
```

[ ]:
```
(1865, 12)
```

[ ]:
```
import plotly.express as px
import plotly.graph_objects as go
```

[ ]:
```
state_code = {'Alabama': 'AL','Alaska': 'AK','Arizona': 'AZ','Arkansas':␣
↪'AR','California': 'CA','Colorado': 'CO','Connecticut': 'CT','Delaware':␣
↪'DE','Florida': 'FL','Georgia': 'GA','Hawaii': 'HI','Idaho': 'ID','Illinois':
↪ 'IL','Indiana': 'IN','Iowa': 'IA','Kansas': 'KS','Kentucky':␣
↪'KY','Louisiana': 'LA','Maine': 'ME','Maryland': 'MD','Massachusetts':␣
↪'MA','Michigan': 'MI','Minnesota': 'MN','Mississippi': 'MS','Missouri':␣
↪'MO','Montana': 'MT','Nebraska': 'NE','Nevada': 'NV','New Hampshire':␣
↪'NH','New Jersey': 'NJ','New Mexico': 'NM','New York': 'NY','North Carolina':
↪ 'NC','North Dakota': 'ND','Ohio': 'OH','Oklahoma': 'OK','Oregon':␣
↪'OR','Pennsylvania': 'PA','Rhode Island': 'RI','South Carolina': 'SC','South␣
↪Dakota': 'SD','Tennessee': 'TN','Texas': 'TX','Utah': 'UT','Vermont':␣
↪'VT','Virginia': 'VA','District of Columbia': 'WA','Washington': 'WA','West␣
↪Virginia': 'WV','Wisconsin': 'WI','Wyoming': 'WY'}
data['state_code'] = data.State.apply(lambda x: state_code[x])
```

[ ]:
```
state_data = data[['Sales', 'Profit', 'state_code']].groupby(['state_code']).
 ↪sum()


fig = go.Figure(data=go.Choropleth(
    locations=state_data.index,
    z = state_data.Sales,
    locationmode = 'USA-states',
    colorscale = 'Viridis_r',
    colorbar_title = 'Sales in USD',
))

fig.update_layout(
    title_text = 'Total State-Wise Sales',
    title_font_family="Times New Roman",
    title_font_size = 22,
    title_font_color="black",
    title_x=0.45,
    geo_scope='usa',
    height=600,
)


fig.show()
```

[ ]:
```
state_data = data[['Sales', 'Profit', 'state_code']].groupby(['state_code']).
 ↪sum()


fig = go.Figure(data=go.Choropleth(
    locations=state_data.index,
    z = state_data.Profit,
    locationmode = 'USA-states',
    colorscale = 'Viridis_r',
    colorbar_title = 'profits in USD',
))

fig.update_layout(
    title_text = 'Total State-Wise profits',
    title_font_family="Times New Roman",
    title_font_size = 22,
    title_font_color="black",
    title_x=0.45,
    geo_scope='usa',
    height=600,
)
```

```
fig.show()
```

[ ]:
```
data.head()
```

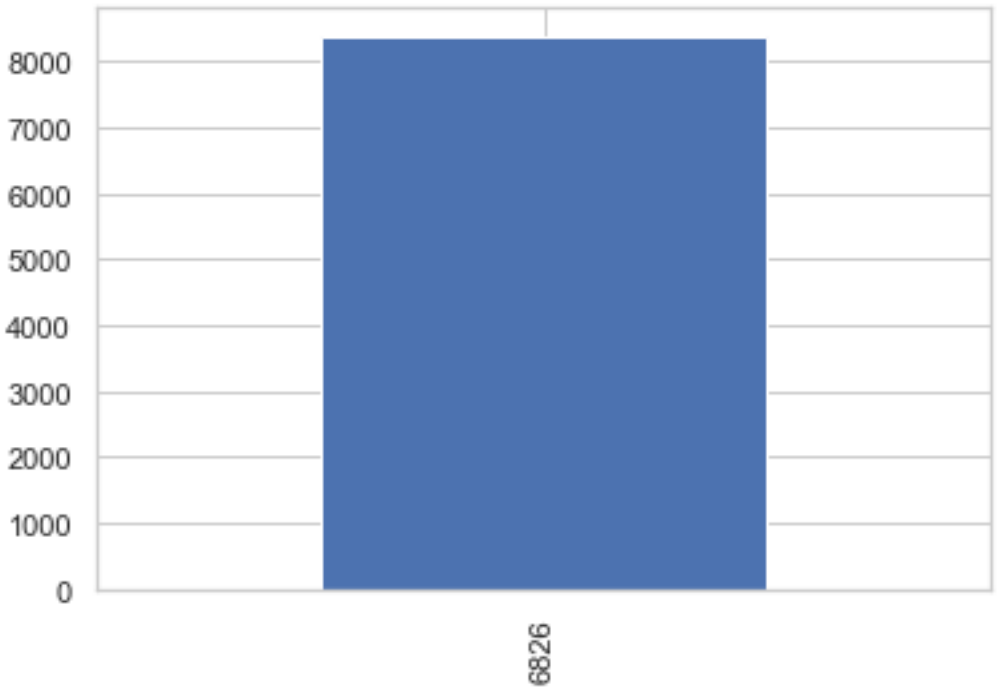
[ ]:
```
         Ship Mode    Segment        Country             City       State  \
0    Second Class   Consumer  United States        Henderson    Kentucky
1    Second Class   Consumer  United States        Henderson    Kentucky
2    Second Class  Corporate  United States      Los Angeles  California
3  Standard Class   Consumer  United States  Fort Lauderdale     Florida
4  Standard Class   Consumer  United States  Fort Lauderdale     Florida

  Region         Category Sub-Category     Sales  Quantity  Discount  \
0  South        Furniture    Bookcases  261.9600         2      0.00
1  South        Furniture      Chairs  731.9400         3      0.00
2   West  Office Supplies       Labels   14.6200         2      0.00
3  South        Furniture       Tables  957.5775         5      0.45
4  South  Office Supplies      Storage   22.3680         2      0.20

     Profit state_code
0   41.9136         KY
1  219.5820         KY
2    6.8714         CA
3 -383.0310         FL
4    2.5164         FL
```

all profit

[ ]:
```
print(round(sum(data.Profit),2))
data.Profit[data.Profit==max(data.Profit)].plot(kind='bar')
```

```
286097.56
```

[ ]:
```
<AxesSubplot:>
```



[ ]:
```
sum(data.Profit)
```

[ ]: 286097.5579000013

all saless

[ ]:
```
round(sum(data.Sales),2)
```

[ ]: 2294599.38

[ ]: