Exploratory_Data_Analysis_Retail

In [45]:
```
import numpy as np
import pandas as pd
import seaborn as sns
from plotnine import *
import warnings
warnings.filterwarnings('ignore')
import matplotlib.pyplot as plt
```

Reading the dataset

In [46]:
```
sample = pd.read_csv("SampleSuperstore.csv")
```

In [47]:
```
sample.head()
```

Out[47]:

	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	0.20	2.5164

In [48]:
```
sample.tail()
```

Out[48]:

	Ship Mode	Segment	Country	City	State	Postal Code	Region	Category	Sub-Category	Sales	Quantity	Discount	Profit
9989	Second Class	Consumer	United States	Miami	Florida	33180	South	Furniture	Furnishings	25.248	3	0.2	4.1028
9990	Standard Class	Consumer	United States	Costa Mesa	California	92627	West	Furniture	Furnishings	91.960	2	0.0	15.6332
9991	Standard Class	Consumer	United States	Costa Mesa	California	92627	West	Technology	Phones	258.576	2	0.2	19.3932
9992	Standard Class	Consumer	United States	Costa Mesa	California	92627	West	Office Supplies	Paper	29.600	4	0.0	13.3200
9993	Second Class	Consumer	United States	Westminster	California	92683	West	Office Supplies	Appliances	243.160	2	0.0	72.9480

In [49]:
```
sample.shape
```

Out[49]:
```
(9994, 13)
```

Checking for the data's information, i.e type

In [50]:
```
sample.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
```

In [51]:
```
sample.describe()
```

Out[51]:

	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

In [52]:
```
sample.isnull().sum()
```

Out[52]:
```
Ship Mode       0
Segment         0
Country         0
City            0
State           0
Postal Code     0
Region          0
Category        0
Sub-Category    0
Sales           0
Quantity        0
Discount        0
Profit          0
dtype: int64
```

Checking for the duplicate data. If yes, then dropping those data

In [53]:
```
sample.duplicated().sum()
```

Out[53]: 17

In [54]:
```
sample.drop_duplicates()
```

Out[54]:

	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	0.20	2.5164
...	...	...	...	...	...	...	...	...	...	...	...	...	...
9989	Second Class	Consumer	United States	Miami	Florida	33180	South	Furniture	Furnishings	25.2480	3	0.20	4.1028
9990	Standard Class	Consumer	United States	Costa Mesa	California	92627	West	Furniture	Furnishings	91.9600	2	0.00	15.6332
9991	Standard Class	Consumer	United States	Costa Mesa	California	92627	West	Technology	Phones	258.5760	2	0.20	19.3932
9992	Standard Class	Consumer	United States	Costa Mesa	California	92627	West	Office Supplies	Paper	29.6000	4	0.00	13.3200
9993	Second Class	Consumer	United States	Westminster	California	92683	West	Office Supplies	Appliances	243.1600	2	0.00	72.9480

9977 rows × 13 columns

In [55]:
```
sample.nunique()
```

Out[55]:
```
Ship Mode          4
Segment            3
Country            1
City             531
State             49
Postal Code      631
Region             4
Category           3
Sub-Category      17
Sales           5825
Quantity          14
Discount          12
Profit          7287
dtype: int64
```

Dropping irrelevant columns

In [56]:
```
col =  ['Postal Code']
sample1 = sample.drop(columns=col, axis=1)
sample1
```

Out[56]:

	Ship Mode	Segment	Country	City	State	Region	Category	Sub-Category	Sales	Quantity	Discount	Profit
0	Second Class	Consumer	United States	Henderson	Kentucky	South	Furniture	Bookcases	261.9600	2	0.00	41.9136
1	Second Class	Consumer	United States	Henderson	Kentucky	South	Furniture	Chairs	731.9400	3	0.00	219.5820
2	Second Class	Corporate	United States	Los Angeles	California	West	Office Supplies	Labels	14.6200	2	0.00	6.8714
3	Standard Class	Consumer	United States	Fort Lauderdale	Florida	South	Furniture	Tables	957.5775	5	0.45	-383.0310
4	Standard Class	Consumer	United States	Fort Lauderdale	Florida	South	Office Supplies	Storage	22.3680	2	0.20	2.5164
...	...	...	...	...	...	...	...	...	...	...	...	...
9989	Second Class	Consumer	United States	Miami	Florida	South	Furniture	Furnishings	25.2480	3	0.20	4.1028
9990	Standard Class	Consumer	United States	Costa Mesa	California	West	Furniture	Furnishings	91.9600	2	0.00	15.6332
9991	Standard Class	Consumer	United States	Costa Mesa	California	West	Technology	Phones	258.5760	2	0.20	19.3932
9992	Standard Class	Consumer	United States	Costa Mesa	California	West	Office Supplies	Paper	29.6000	4	0.00	13.3200
9993	Second Class	Consumer	United States	Westminster	California	West	Office Supplies	Appliances	243.1600	2	0.00	72.9480

9994 rows × 12 columns

Checking statistical relation between the various rows & columns

In [57]:
```
# Correlation between variables
sample1.corr()
```

Out[57]:

	Sales	Quantity	Discount	Profit
Sales	1.000000	0.200795	-0.028190	0.479064
Quantity	0.200795	1.000000	0.008623	0.066253
Discount	-0.028190	0.008623	1.000000	-0.219487
Profit	0.479064	0.066253	-0.219487	1.000000

In [58]:
```
# Covariance of columns
sample1.cov()
```

Out[58]:

	Sales	Quantity	Discount	Profit
Sales	388434.455308	278.459923	-3.627228	69944.096586
Quantity	278.459923	4.951113	0.003961	34.534769
Discount	-3.627228	0.003961	0.042622	-10.615173
Profit	69944.096586	34.534769	-10.615173	54877.798055

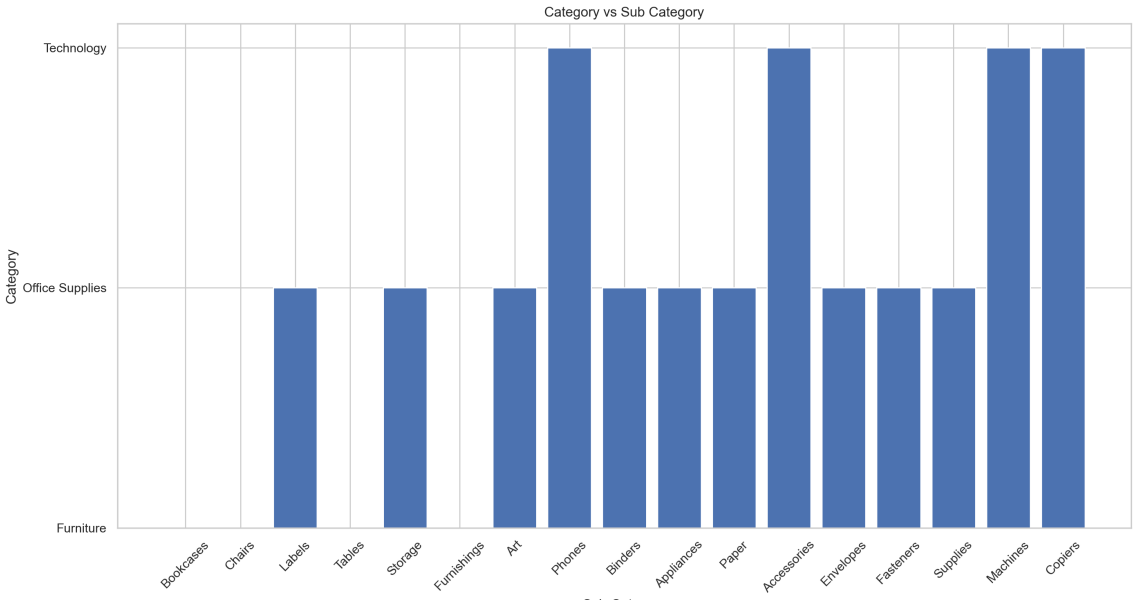
In [59]:
```
sample1.head() # loads the first five rows
```

Out[59]:

	Ship Mode	Segment	Country	City	State	Region	Category	Sub-Category	Sales	Quantity	Discount	Profit
0	Second Class	Consumer	United States	Henderson	Kentucky	South	Furniture	Bookcases	261.9600	2	0.00	41.9136
1	Second Class	Consumer	United States	Henderson	Kentucky	South	Furniture	Chairs	731.9400	3	0.00	219.5820
2	Second Class	Corporate	United States	Los Angeles	California	West	Office Supplies	Labels	14.6200	2	0.00	6.8714
3	Standard Class	Consumer	United States	Fort Lauderdale	Florida	South	Furniture	Tables	957.5775	5	0.45	-383.0310
4	Standard Class	Consumer	United States	Fort Lauderdale	Florida	South	Office Supplies	Storage	22.3680	2	0.20	2.5164

Data Visualization

In [60]:
```
plt.figure(figsize=(16,8))
plt.bar('Sub-Category', 'Category', data=sample1)
plt.title('Category vs Sub Category')
plt.xlabel('Sub-Category')
plt.ylabel('Category')
plt.xticks(rotation=45)
plt.show()
```

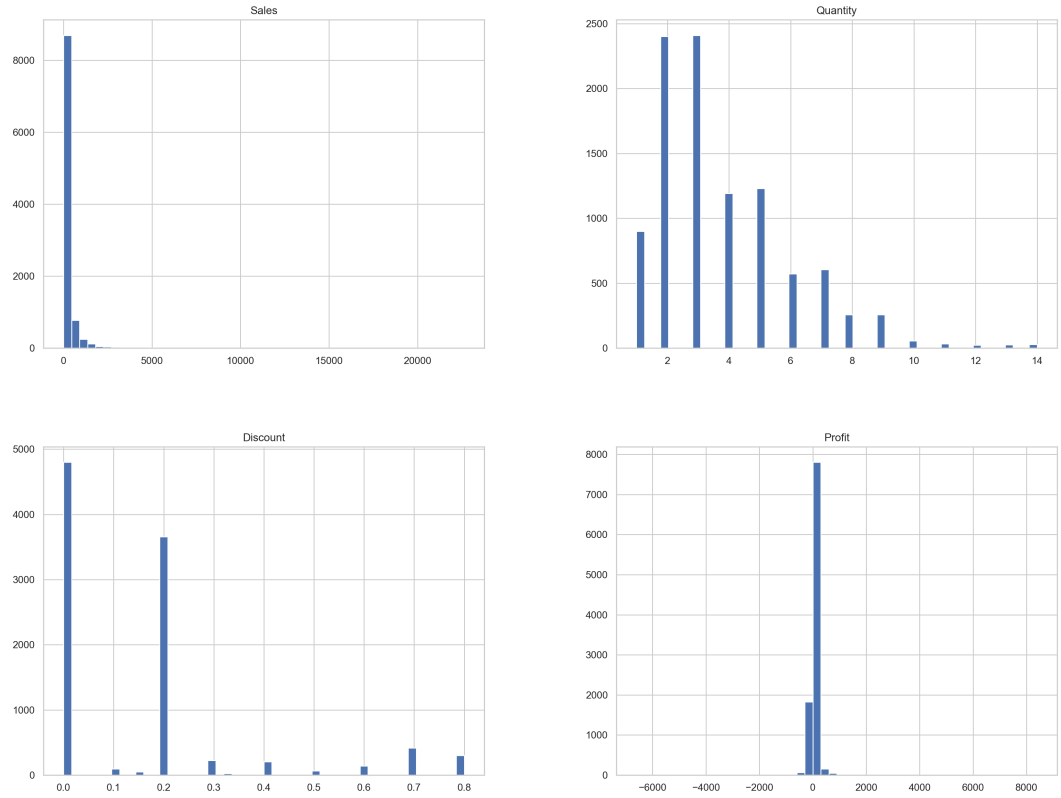


In [61]:
```
sample1.corr() # Checking the correlation
```

Out[61]:

	Sales	Quantity	Discount	Profit
Sales	1.000000	0.200795	-0.028190	0.479064
Quantity	0.200795	1.000000	0.008623	0.066253
Discount	-0.028190	0.008623	1.000000	-0.219487
Profit	0.479064	0.066253	-0.219487	1.000000

In [62]:
```
sample1.hist(bins=50,figsize=(20,15))
plt.show();
```

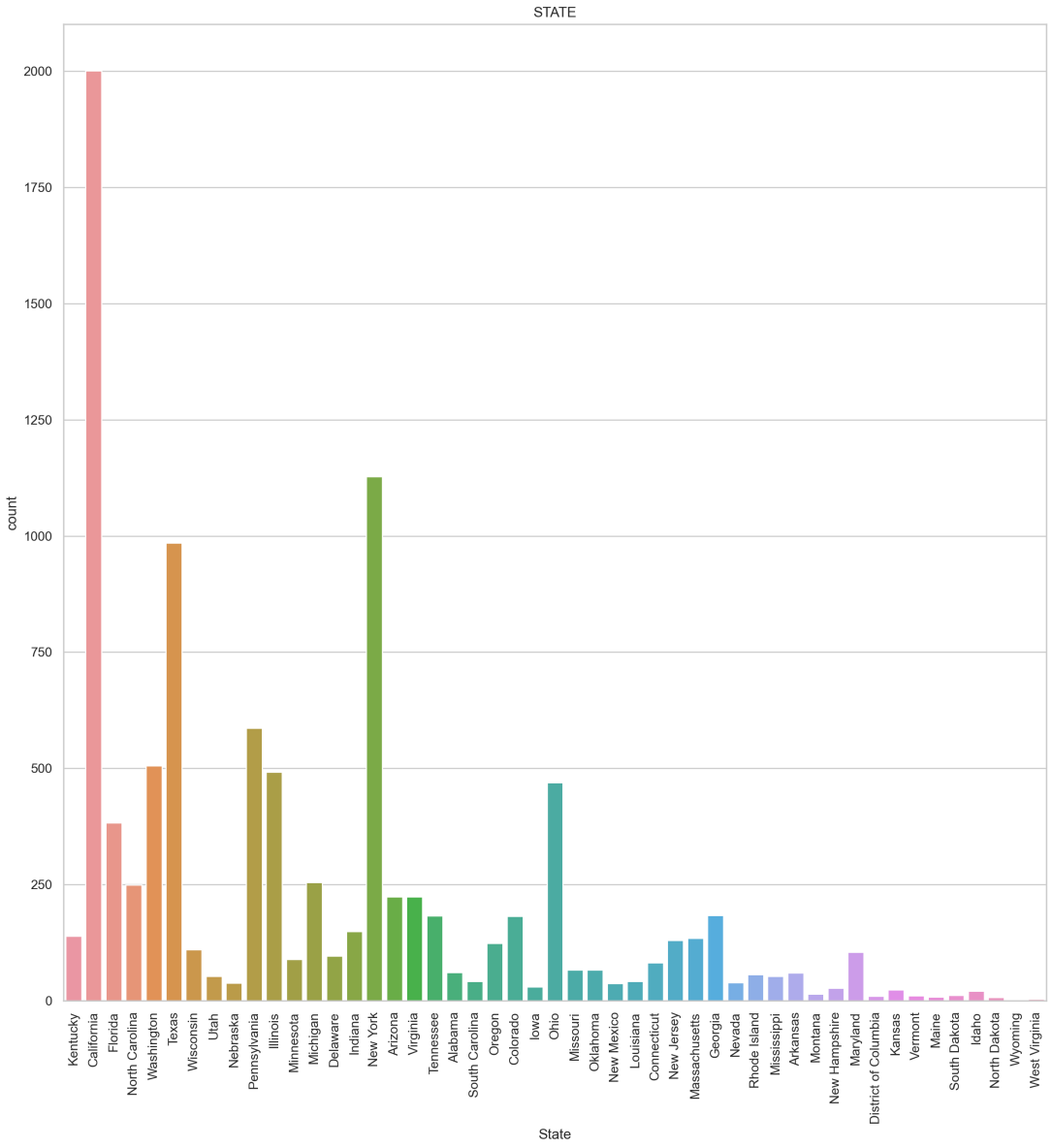


So, the data here is not normal as revealed by this histogram graph.

In [63]:
```
# Count the total repeatable states
sample1['State'].value_counts()
```

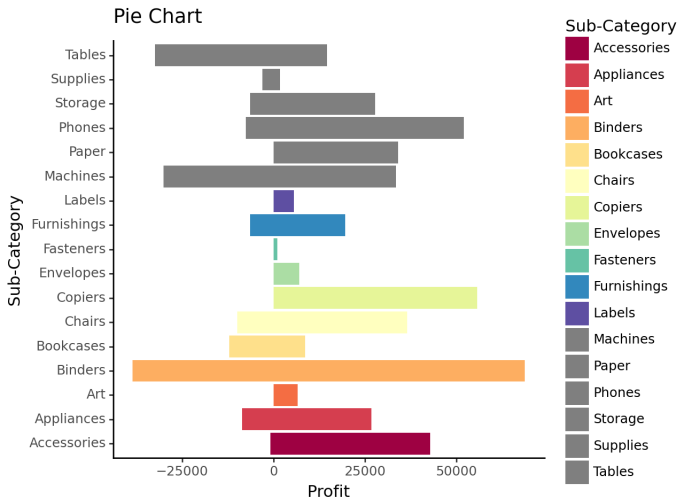
Out[63]:
```
California              2001
New York                1128
Texas                    985
Pennsylvania             587
Washington               506
Illinois                 492
Ohio                     469
Florida                  383
Michigan                 255
North Carolina           249
Arizona                  224
Virginia                 224
Georgia                  184
Tennessee                183
Colorado                 182
Indiana                  149
Kentucky                 139
Massachusetts            135
New Jersey               130
Oregon                   124
Wisconsin                110
Maryland                 105
Delaware                  96
Minnesota                 89
Connecticut               82
Oklahoma                  66
Missouri                  66
Alabama                   61
Arkansas                  60
Rhode Island              56
Utah                      53
Mississippi               53
Louisiana                 42
South Carolina            42
Nevada                    39
Nebraska                  38
New Mexico                37
Iowa                      30
New Hampshire             27
Kansas                    24
Idaho                     21
Montana                   15
South Dakota              12
Vermont                   11
District of Columbia      10
Maine                      8
North Dakota               7
West Virginia              4
Wyoming                    1
Name: State, dtype: int64
```

In [66]:
```
plt.figure(figsize=(15,15))
sns.countplot(x=sample1['State'])
plt.xticks(rotation=90)
plt.title("STATE")
plt.show()
```



In [25]:
```
Profit_plot = (ggplot(sample, aes(x='Sub-Category', y='Profit', fill='Sub-Category')) + geom_col() + coord_flip()
+ scale_fill_brewer(type='div', palette="Spectral") + theme_classic() + ggtitle('Pie Chart'))

display(Profit_plot)
```



<Figure Size: (640 x 480)>

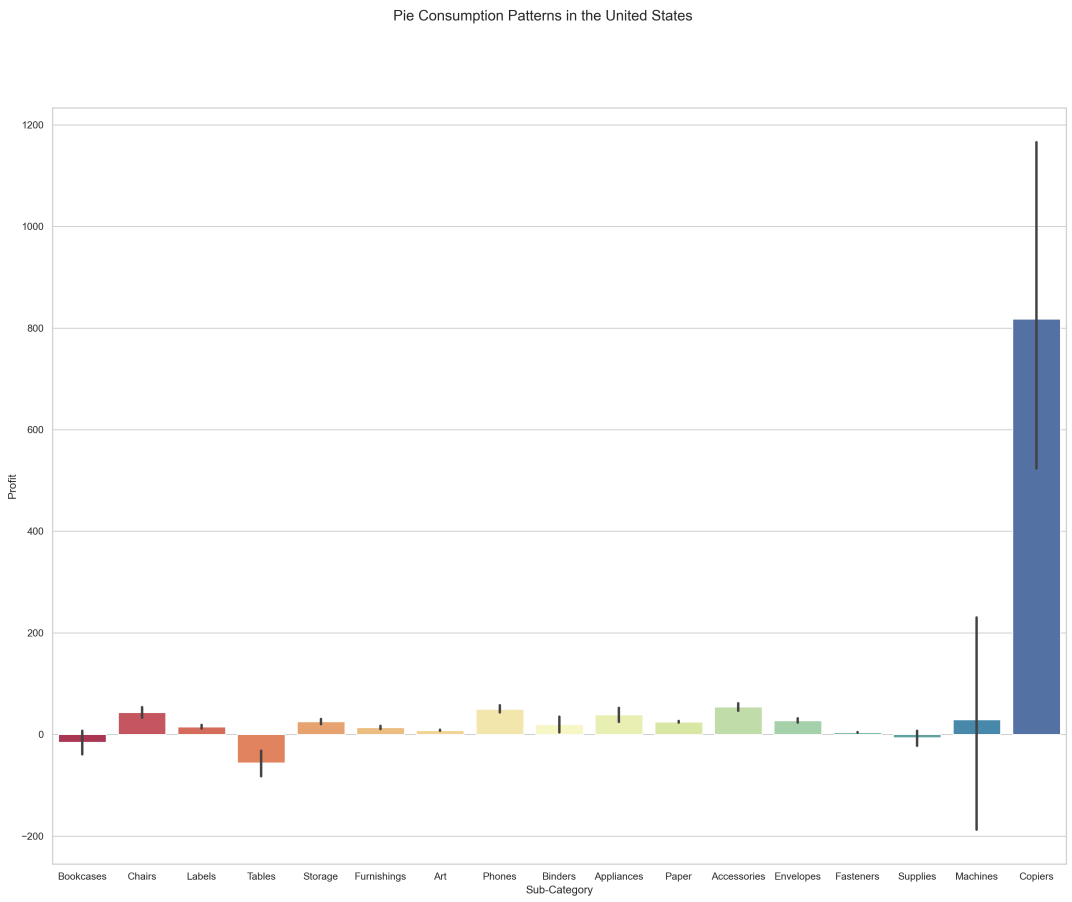
The above pie chart shows the profit and loss of each and every subcategories.

Here from the graph we can visualize that "binders" sub-category has suffered the highest amount of loss and also profit amongst all other sub-Categories (For now we can't say that what is the reason it may be because of discounts given on binders subcategory).

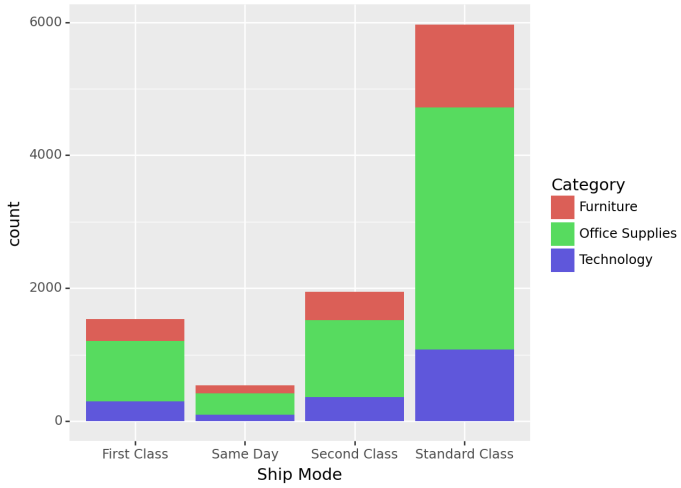
Next,"Copiers" sub-category has gained highest amount of profit with no loss.There are other sub-categories too haven't faced any kind of losses but their profit margins are also low.

Next, suffering from highest loss is machines.

In [26]:
```
sns.set(style="whitegrid")
plt.figure(2, figsize=(20,15))
sns.barplot(x='Sub-Category',y='Profit', data=sample, palette='Spectral')
plt.suptitle('Pie Consumption Patterns in the United States', fontsize=16)
plt.show()
```



In [31]:
```
ggplot(sample, aes(x='Ship Mode', fill = 'Category')) + geom_bar(stat = 'count')
```



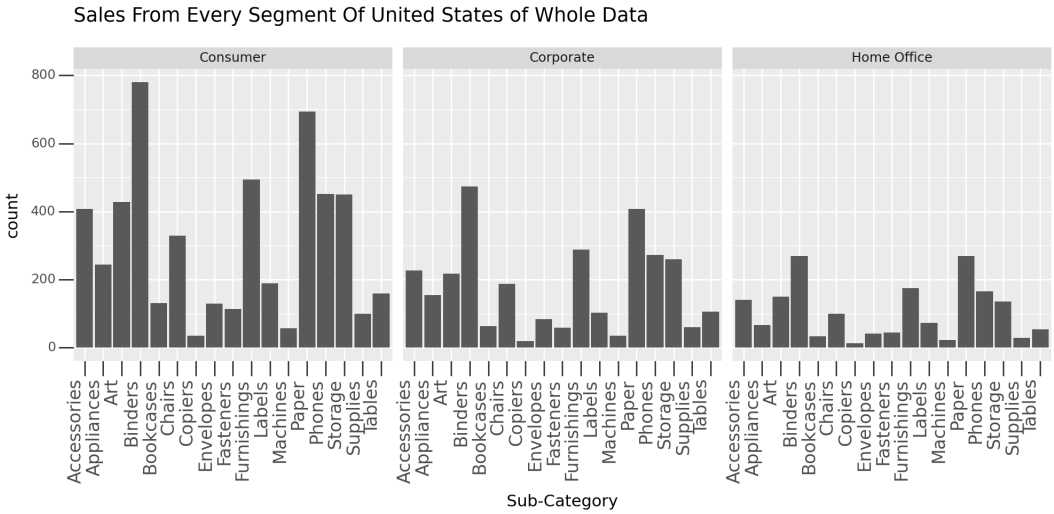
Out[31]: <Figure Size: (640 x 480)>

In [28]:
```
figsize=(15,10)
sns.pairplot(sample1,hue='Sub-Category')
plt.show
```

Out[28]: <function matplotlib.pyplot.show(close=None, block=None)>

From the above plot we can say that our data is not normal and it has some amount of outliers too. Let's explore more about these outliers by using boxplots. 1st we'll check sales from every segments of whole data.

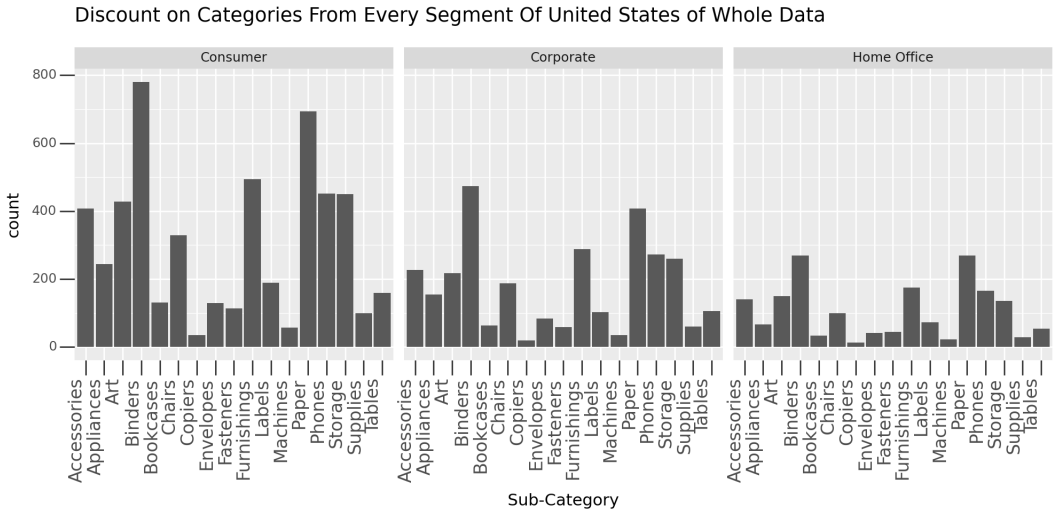
In [32]:
```
flip_xlabels = theme(axis_text_x = element_text(angle=90, hjust=1),figure_size=(10,5),
                     axis_ticks_length_major=10,axis_ticks_length_minor=5)
(ggplot(sample, aes(x='Sub-Category', fill='Sales')) + geom_bar() + facet_wrap(['Segment'])
+ flip_xlabels +theme(axis_text_x = element_text(size=12))+ggtitle("Sales From Every Segment Of United States of Whole Data"))
```



Out[32]: <Figure Size: (1000 x 500)>

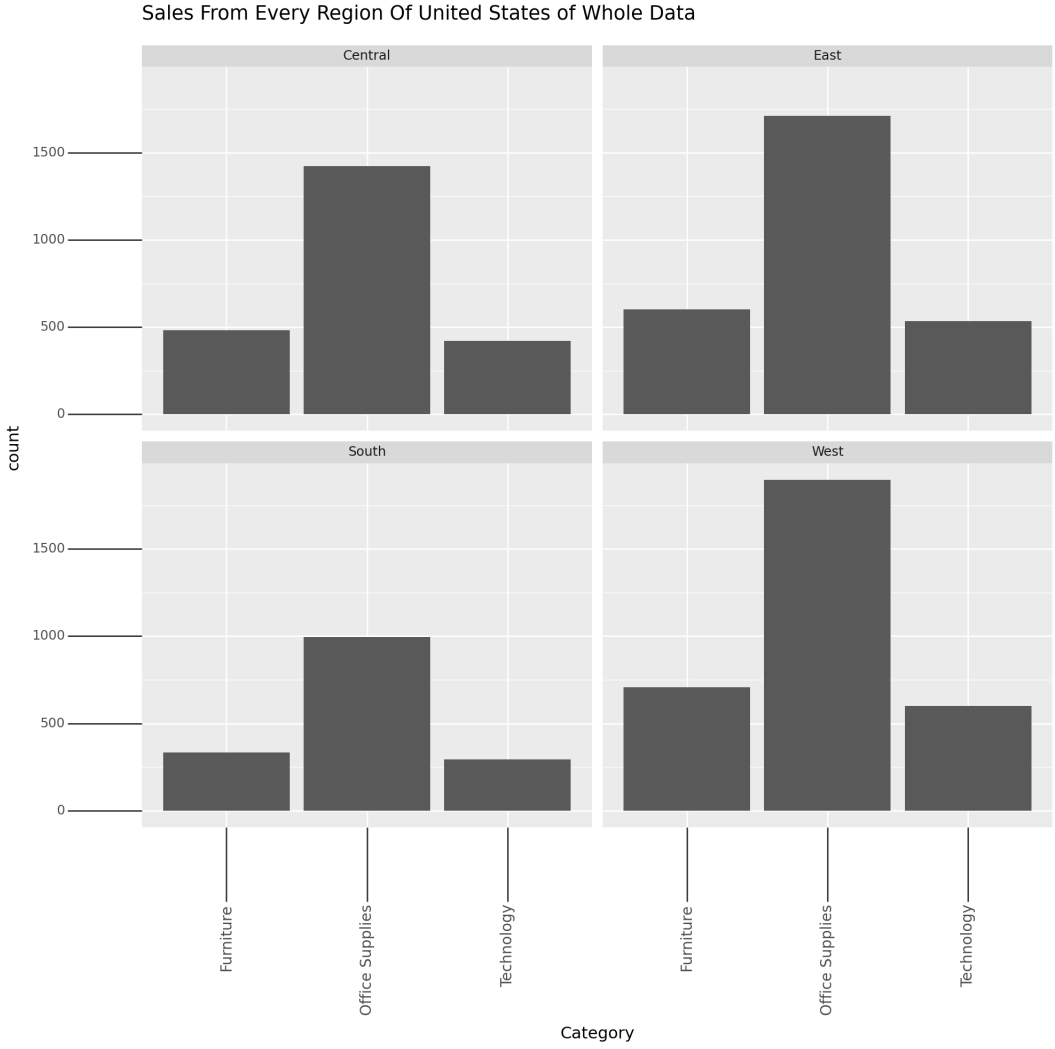
From the above Graph we can say that "Home Office" segment has less purchased sub-categories and in that "Tables", "Supplies", "Machines", "Copiers", "Bookcases" has the lowest sales. "Consumer" has purchased more sub-categories as compared to other segments.

In [33]:
```
flip_xlabels = theme(axis_text_x = element_text(angle=90, hjust=1),figure_size=(10,5),
                     axis_ticks_length_major=10,axis_ticks_length_minor=5)
(ggplot(sample, aes(x='Sub-Category', fill='Discount')) + geom_bar() + facet_wrap(['Segment'])
+ flip_xlabels +theme(axis_text_x = element_text(size=12))+ggtitle("Discount on Categories From Every Segment Of United States of Whole Data"))
```



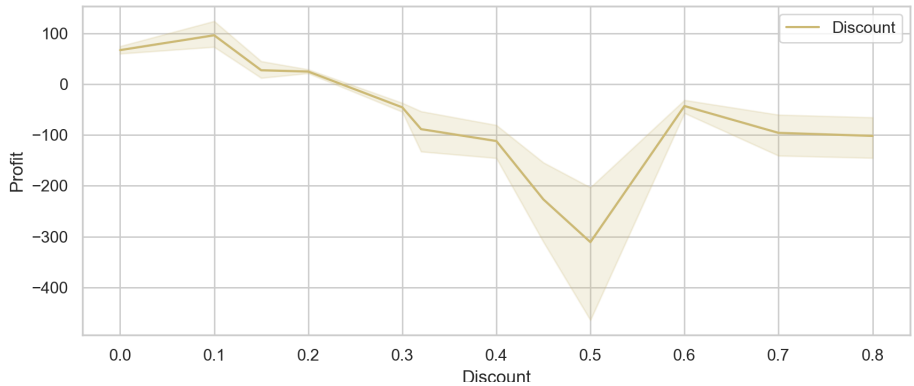
Out[33]: <Figure Size: (1000 x 500)>

In [34]:
```
flip_xlabels = theme(axis_text_x = element_text(angle=90, hjust=10),figure_size=(10,10),
                     axis_ticks_length_major=50,axis_ticks_length_minor=50)
(ggplot(sample1, aes(x='Category', fill='Sales')) + geom_bar() + theme(axis_text_x = element_text(size=10))
+ facet_wrap(['Region']) + flip_xlabels+ ggtitle("Sales From Every Region Of United States of Whole Data"))
```



Out[34]: <Figure Size: (1000 x 1000)>

In [36]:
```
plt.figure(figsize=(10,4))
sns.lineplot(x='Discount', y='Profit', data=sample1, color='y', label='Discount')
plt.legend()
plt.show()
```



In [37]:
```
import plotly.express as px
import plotly.graph_objects as go
from plotly.subplots import make_subplots
```

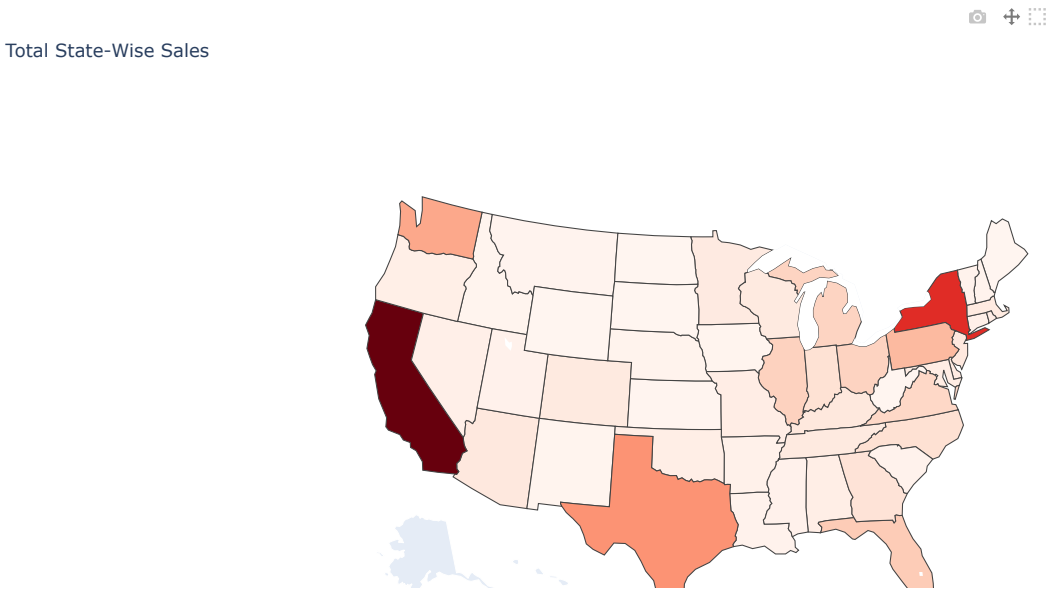
In [38]:
```
state_code = {'Alabama': 'AL','Alaska': 'AK','Arizona': 'AZ','Arkansas': 'AR','California': 'CA','Colorado': 'CO','Connecticut': 'CT','Delaware': 'DE','Florida': 'FL','Geo
sample1['state_code'] = sample1.State.apply(lambda x: state_code[x])
```

In [39]:
```
state_data = sample1[['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 = 'Reds',
    colorbar_title = 'Sales in USD',
))

fig.update_layout(
    title_text = 'Total State-Wise Sales',
    geo_scope='usa',
    height=800,
)

fig.show()
```



Now, let us analyze the sales of a few random states from each profit bracket (high profit, medium profit, low profit, low loss and high loss) and try to observe some crucial trends which might help us in increasing the sales.

We have a few **questions** to answer here.

1. What products do the most profit making states buy?
2. What products do the loss bearing states buy?
3. What product segment needs to be improved in order to drive the profits higher?

In [40]:
```
def state_data_viewer(states):
    """Plots the turnover generated by different product categories and sub-categories for the list of given states.
    Args:
```

```
        states- List of all the states you want the plots for
    Returns:
        None
    """
    product_data = sample1.groupby(['State'])
    for state in states:
        data = product_data.get_group(state).groupby(['Category'])
        fig, ax = plt.subplots(1, 3, figsize = (28,5))
        fig.suptitle(state, fontsize=14)
        ax_index = 0
        for cat in ['Furniture', 'Office Supplies', 'Technology']:
            cat_data = data.get_group(cat).groupby(['Sub-Category']).sum()
            sns.barplot(x = cat_data.Profit, y = cat_data.index, ax = ax[ax_index])
            ax[ax_index].set_ylabel(cat)
            ax_index +=1
        fig.show()
```

In [41]:
```
states = ['California', 'Washington', 'Mississippi', 'Arizona', 'Texas']
state_data_viewer(states)
```

Thank You!

GitHub: https://github.com/anujtiwari21?tab=repositories