GRIP@The Spark Foundation- Data Science & Business Analytics Internship

Author - Samarth Waghmode

Task 3: Exploratory Data Analysis - Retail

Dataset used: Sample Superstore dataset

It can be downloaded through the following link - [https://bit.ly/3i4rbWl (https://bit.ly/3i4rbWl)](https://bit.ly/3i4rbWl)

Problem Statement(s) :

*** As a business manager, try to find out the weak areas where you can work to make more profit.

Import necessary libraries

In [1]:

```
# Importing Libraries required for data analysis
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

import warnings
warnings.filterwarnings('ignore')
```

In [2]:

```
# load the data
df = pd.read_csv("SampleSuperstore.csv")
```

In [3]:
```
df.sample(5)
```

Out[3]:

	Ship Mode	Segment	Country	City	State	Postal Code	Region	Category	Sub-Category	Sales
9443	Standard Class	Home Office	United States	Jacksonville	Florida	32216	South	Technology	Phones	219.184
695	First Class	Home Office	United States	Chester	Pennsylvania	19013	East	Office Supplies	Labels	47.360
4410	Standard Class	Home Office	United States	Los Angeles	California	90004	West	Office Supplies	Art	107.940
6862	Standard Class	Consumer	United States	Los Angeles	California	90008	West	Furniture	Chairs	218.352
8111	Second Class	Consumer	United States	San Angelo	Texas	76903	Central	Furniture	Chairs	248.430

In [4]:
```
df.head()
```

Out[4]:

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

In [5]:
```
df.tail()
```

Out[5]:

	Ship Mode	Segment	Country	City	State	Postal Code	Region	Category	Sub-Category	Sales	Q
9989	Second Class	Consumer	United States	Miami	Florida	33180	South	Furniture	Furnishings	25.248	
9990	Standard Class	Consumer	United States	Costa Mesa	California	92627	West	Furniture	Furnishings	91.960	
9991	Standard Class	Consumer	United States	Costa Mesa	California	92627	West	Technology	Phones	258.576	
9992	Standard Class	Consumer	United States	Costa Mesa	California	92627	West	Office Supplies	Paper	29.600	
9993	Second Class	Consumer	United States	Westminster	California	92683	West	Office Supplies	Appliances	243.160	

In [6]:
```
df.shape
```

Out[6]:
```
(9994, 13)
```

In [7]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9994 entries, 0 to 9993
Data columns (total 13 columns):
Ship Mode       9994 non-null object
Segment         9994 non-null object
Country         9994 non-null object
City            9994 non-null object
State           9994 non-null object
Postal Code     9994 non-null int64
Region          9994 non-null object
Category        9994 non-null object
Sub-Category    9994 non-null object
Sales           9994 non-null float64
Quantity        9994 non-null int64
Discount        9994 non-null float64
Profit          9994 non-null float64
dtypes: float64(3), int64(2), object(8)
memory usage: 1015.1+ KB
```

In [8]:

```
df.describe()
```

Out[8]:

	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 [9]:

```
df.drop(["Country", "Postal Code"], axis=1, inplace=True)
df
```

Out[9]:

	Ship Mode	Segment	City	State	Region	Category	Sub-Category	Sales	Quantity	Discou
0	Second Class	Consumer	Henderson	Kentucky	South	Furniture	Bookcases	261.9600	2	0.0
1	Second Class	Consumer	Henderson	Kentucky	South	Furniture	Chairs	731.9400	3	0.0
2	Second Class	Corporate	Los Angeles	California	West	Office Supplies	Labels	14.6200	2	0.0
3	Standard Class	Consumer	Fort Lauderdale	Florida	South	Furniture	Tables	957.5775	5	0.4
4	Standard Class	Consumer	Fort Lauderdale	Florida	South	Office Supplies	Storage	22.3680	2	0.2
...	...	...	...	...	...	...	...	...	...	.
9989	Second Class	Consumer	Miami	Florida	South	Furniture	Furnishings	25.2480	3	0.2
9990	Standard Class	Consumer	Costa Mesa	California	West	Furniture	Furnishings	91.9600	2	0.0
9991	Standard Class	Consumer	Costa Mesa	California	West	Technology	Phones	258.5760	2	0.2
9992	Standard Class	Consumer	Costa Mesa	California	West	Office Supplies	Paper	29.6000	4	0.0
9993	Second Class	Consumer	Westminster	California	West	Office Supplies	Appliances	243.1600	2	0.0

9994 rows × 11 columns

In [10]:

```
#Total Sales:
print("Total sales are {}".format(df["Sales"].sum()))

#Total Profit:
print("Total profit is {}".format(df["Profit"].sum()))
```

```
Total sales are 2297200.8603
Total profit is 286397.0217
```

In [11]:

```
df.columns
```

Out[11]:

```
Index(['Ship Mode', 'Segment', 'City', 'State', 'Region', 'Category',
       'Sub-Category', 'Sales', 'Quantity', 'Discount', 'Profit'],
      dtype='object')
```

In [12]:

```
df.duplicated().sum()
```

Out[12]:

```
50
```

In [13]:

```
df.drop_duplicates(inplace=True)
```

In [14]:

```
df.duplicated().sum()
```

Out[14]:

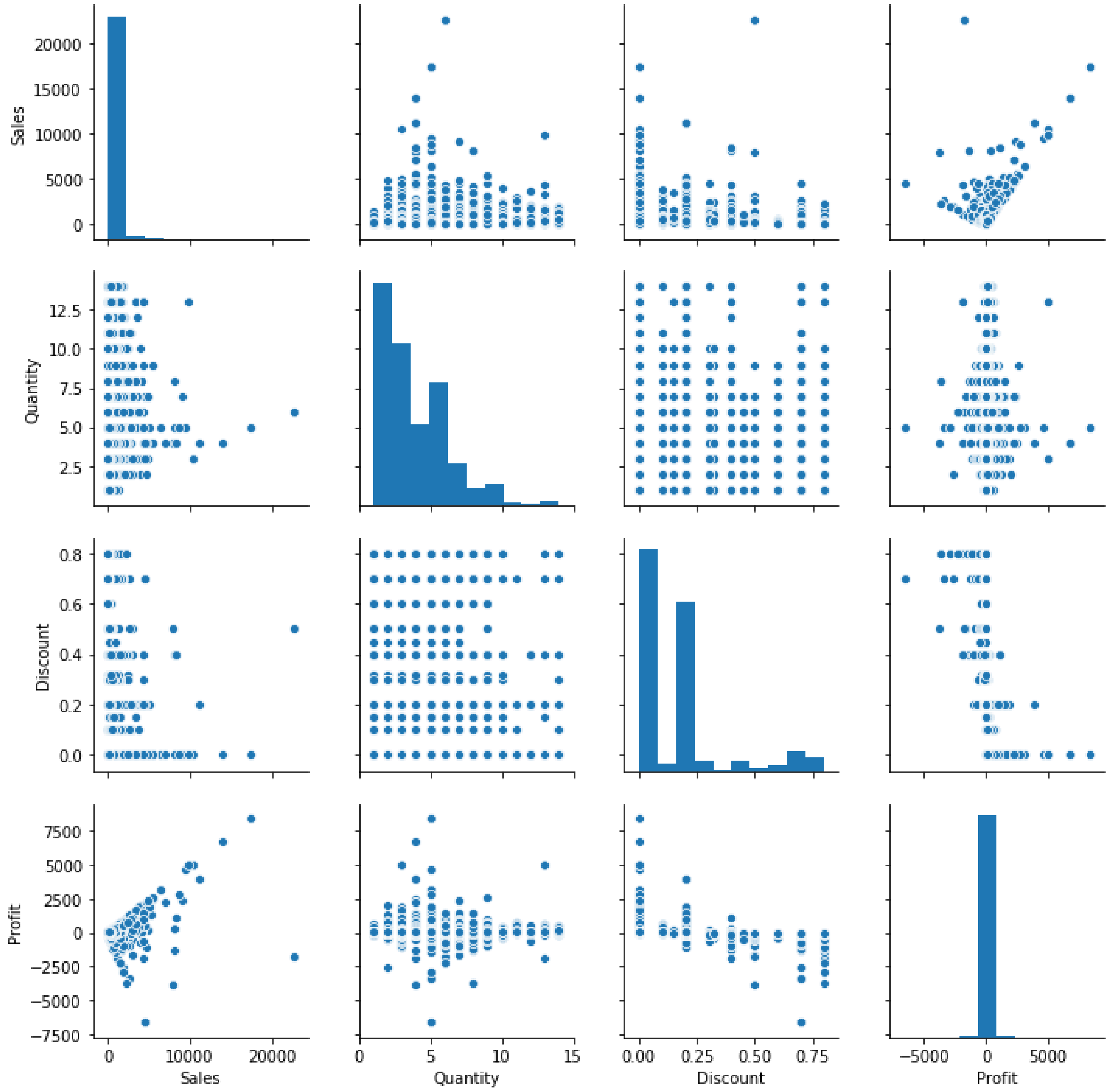
```
0
```

In [15]:

```
sns.pairplot(df)
```

Out[15]:

```
<seaborn.axisgrid.PairGrid at 0x1b41ff994c8>
```



1. As Discount increases Profit decreases
2. As Discount increases Sales decrease
3. As Sales increase Profit increases

In [16]:

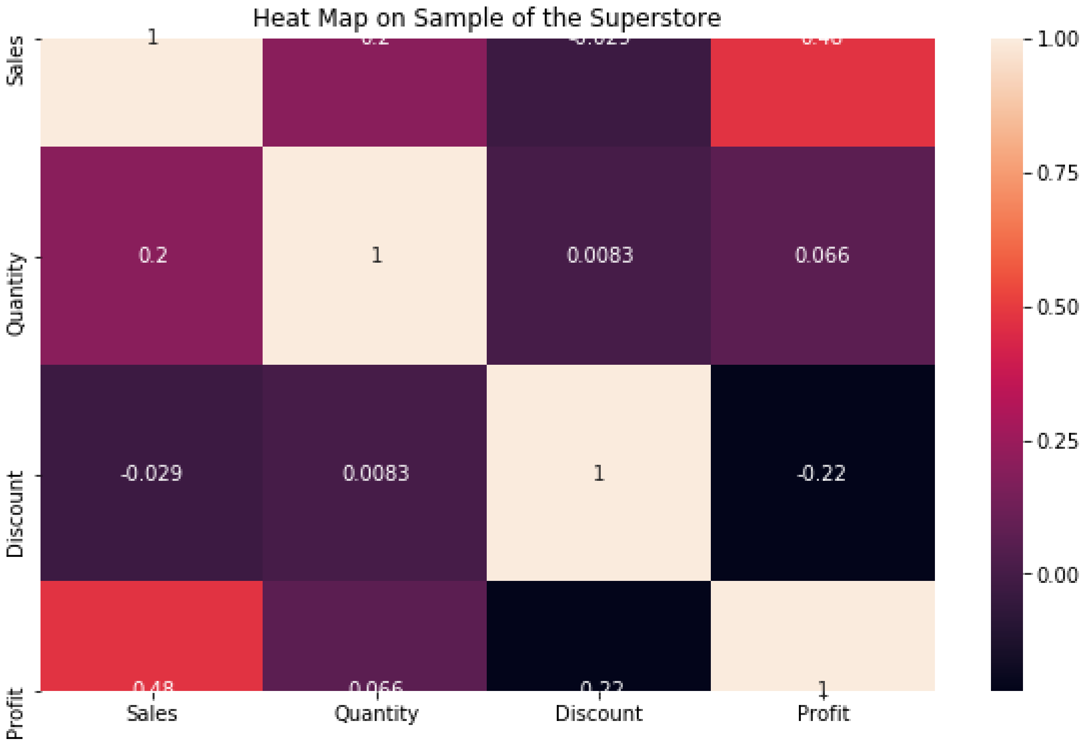
```
df.corr()
```

Out[16]:

	Sales	Quantity	Discount	Profit
Sales	1.000000	0.200469	-0.028625	0.479078
Quantity	0.200469	1.000000	0.008307	0.066089
Discount	-0.028625	0.008307	1.000000	-0.219939
Profit	0.479078	0.066089	-0.219939	1.000000

In [17]:

```
plt.figure(figsize=(10,6))
sns.heatmap(df.corr(),annot=True)
plt.title("Heat Map on Sample of the Superstore")
plt.show()
```



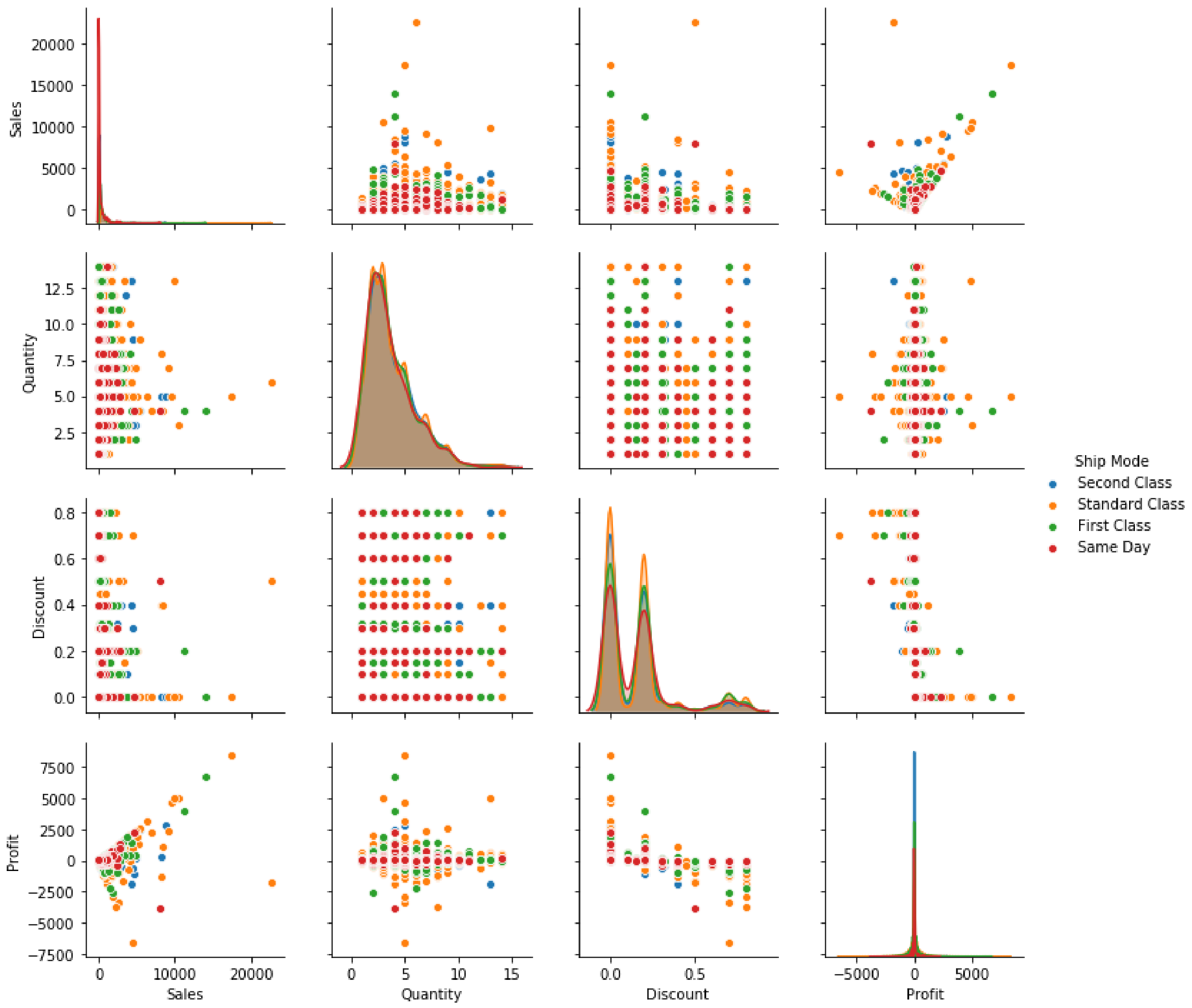
1. Most correlation: Sales and Profit
2. Least correlation: Discount and Quantity

In [18]:

```
sns.pairplot(df, hue="Ship Mode")
```

Out[18]:

```
<seaborn.axisgrid.PairGrid at 0x1b420925d08>
```



In [19]:

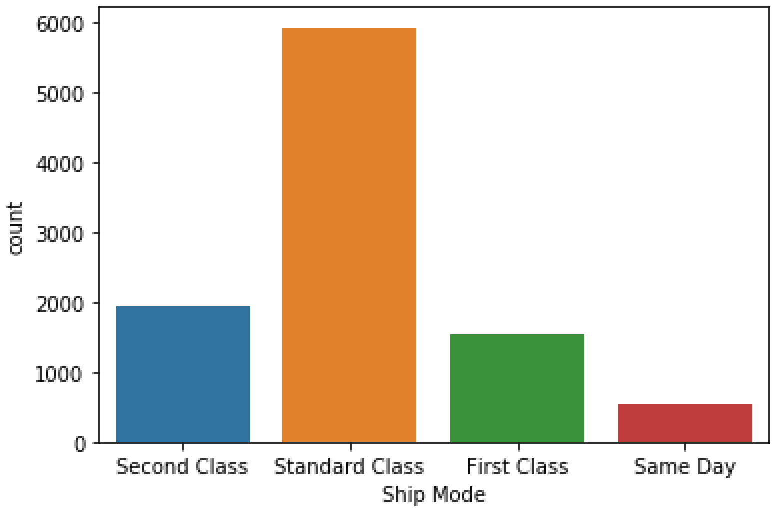
```
df["Ship Mode"].value_counts()
```

Out[19]:

```
Standard Class    5930
Second Class      1941
First Class       1531
Same Day           542
Name: Ship Mode, dtype: int64
```

```
In [20]: sns.countplot(x=df["Ship Mode"])
```

```
Out[20]: <matplotlib.axes._subplots.AxesSubplot at 0x1b4226a1288>
```



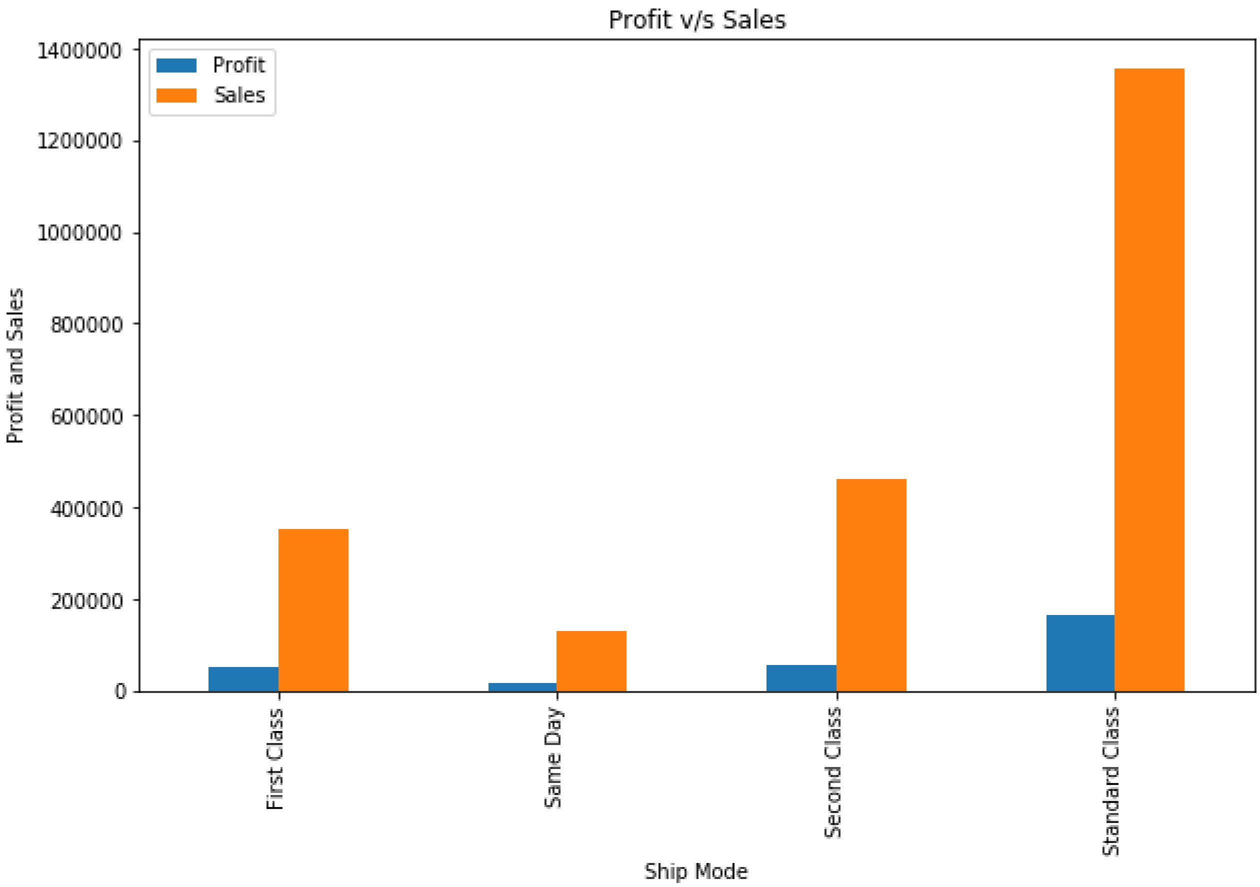
1. Most opted Ship Mode: Standard Class
2. Least opted Ship Mode: Same Day

```
In [21]: ps=df.groupby("Ship Mode")[["Profit","Sales"]].sum()
         ps
```

Out[21]:

	Profit	Sales
Ship Mode		
First Class	48910.4477	3.512746e+05
Same Day	15871.8869	1.283217e+05
Second Class	57425.5716	4.591240e+05
Standard Class	163889.6517	1.355879e+06

```
In [22]: ps.plot(kind="bar", figsize=(10,6))
         plt.title("Profit v/s Sales")
         plt.ylabel("Profit and Sales")
         plt.show()
```



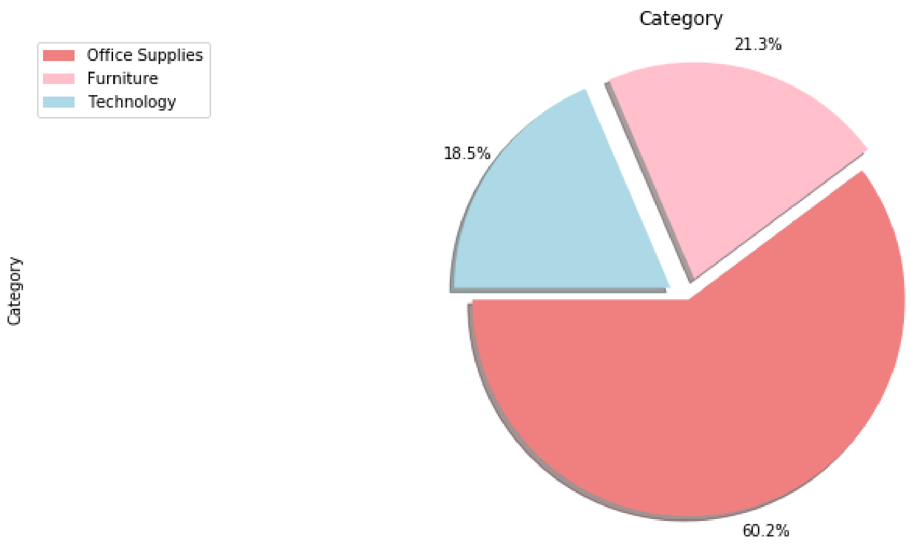
1. Maximum Profit and Sales : Standard Class
2. Minimum Profit and Sales : Same Day

```
In [23]: cat=df["Category"].value_counts()
         cat
```

```
Out[23]: Office Supplies    5986
         Furniture          2114
         Technology         1844
         Name: Category, dtype: int64
```

In [24]:

```
explode_list=[0,0.1,0.1]
colors_list=["lightcoral","pink","lightblue"]
cat.plot(kind="pie", figsize=(15,6),autopct="%1.1f%%",shadow=True, startangle=1
80,
                                   explode=explode_list, labels=None, pctdistan
ce=1.12, colors=colors_list)
plt.title("Category")
plt.axis("equal")
plt.legend(labels=cat.index,loc="upper left")
plt.show()
```



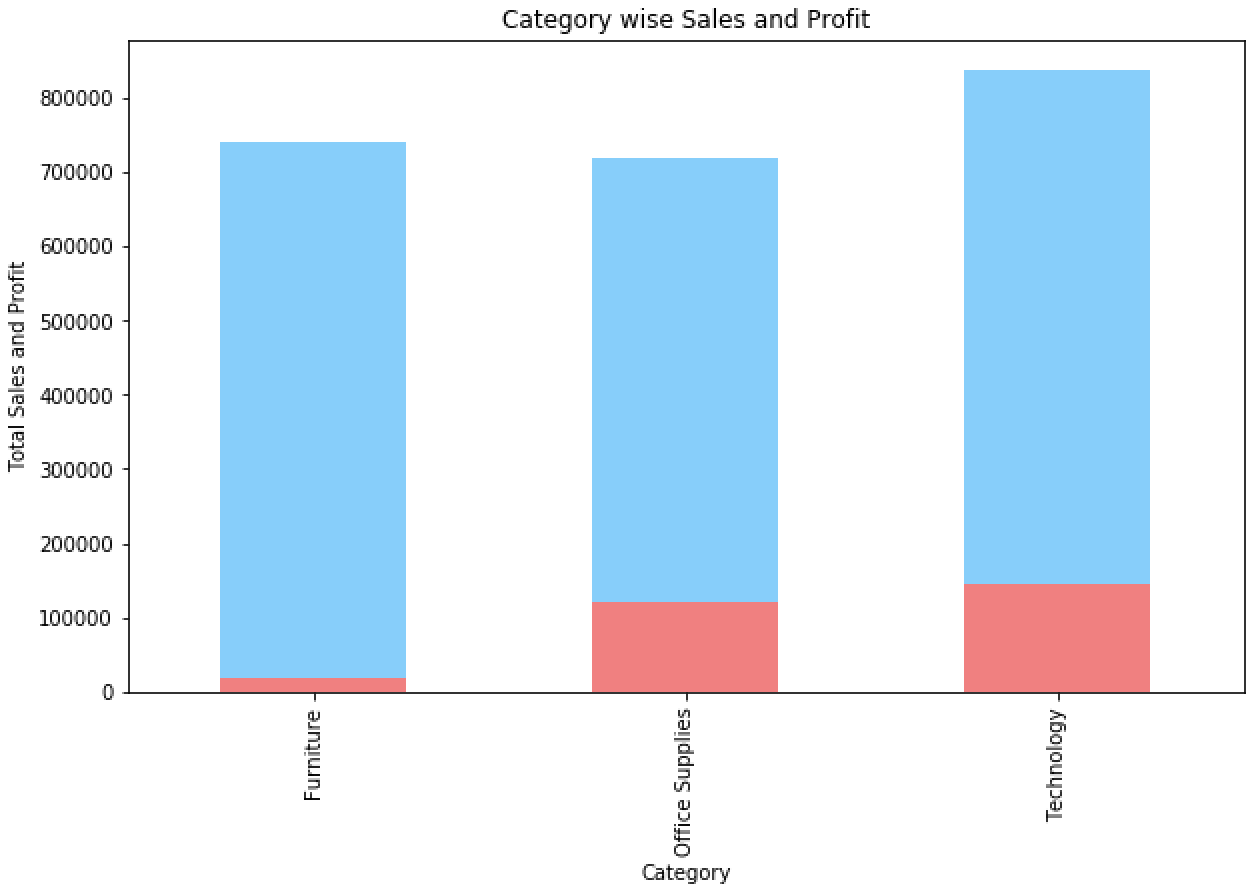
Major distribution of business is in Office Supplies and Least in Technology

In [25]:

```
#Category wise Sales
cs=df.groupby("Category").Sales.sum()
#Category wise Profit
cp=df.groupby("Category").Profit.sum()
```

In [26]:

```
#Sales
ax0=cs.plot(kind="bar", figsize=(10,6), color="lightskyblue")

#Profit
ax0=cp.plot(kind="bar", figsize=(10,6), color="lightcoral")

ax0.set_title("Category wise Sales and Profit")
ax0.set_ylabel("Total Sales and Profit")

plt.show()
```



1. Maximum Profit and Sales in Category: Technology
2. Minimum Profit and Sales in Category: Office Supplies

Sub-Category

In [27]:

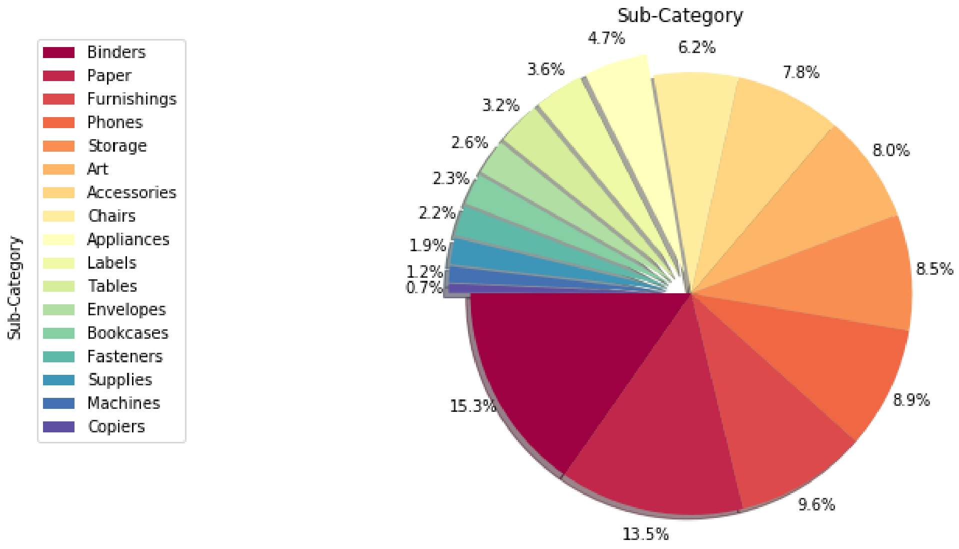
```
sub=df["Sub-Category"].value_counts()
sub
```

Out[27]:

```
Binders        1518
Paper          1344
Furnishings     954
Phones          888
Storage         845
Art             793
Accessories     773
Chairs          615
Appliances      466
Labels          359
Tables          319
Envelopes       254
Bookcases       226
Fasteners       217
Supplies        190
Machines        115
Copiers          68
Name: Sub-Category, dtype: int64
```

In [28]:

```
from matplotlib import cm
cmap = cm.get_cmap('Spectral')
explode_list=[0,0,0,0,0,0,0,0,0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1]
sub.plot(kind="pie", figsize=(15,6),autopct="%1.1f%%",shadow=True,startangle=18
0,
                                   explode=explode_list, labels=None, pctdistan
ce=1.11,cmap=cmap)
plt.title("Sub-Category")
plt.axis("equal")
plt.legend(labels=sub.index,loc="upper left")
plt.show()
```



1. Major distribution of business is in Binders, Paper and Furnishings
2. Least distribution of business is in Copiers, Machines and Supplies

Category and Sub-Category

In [29]:

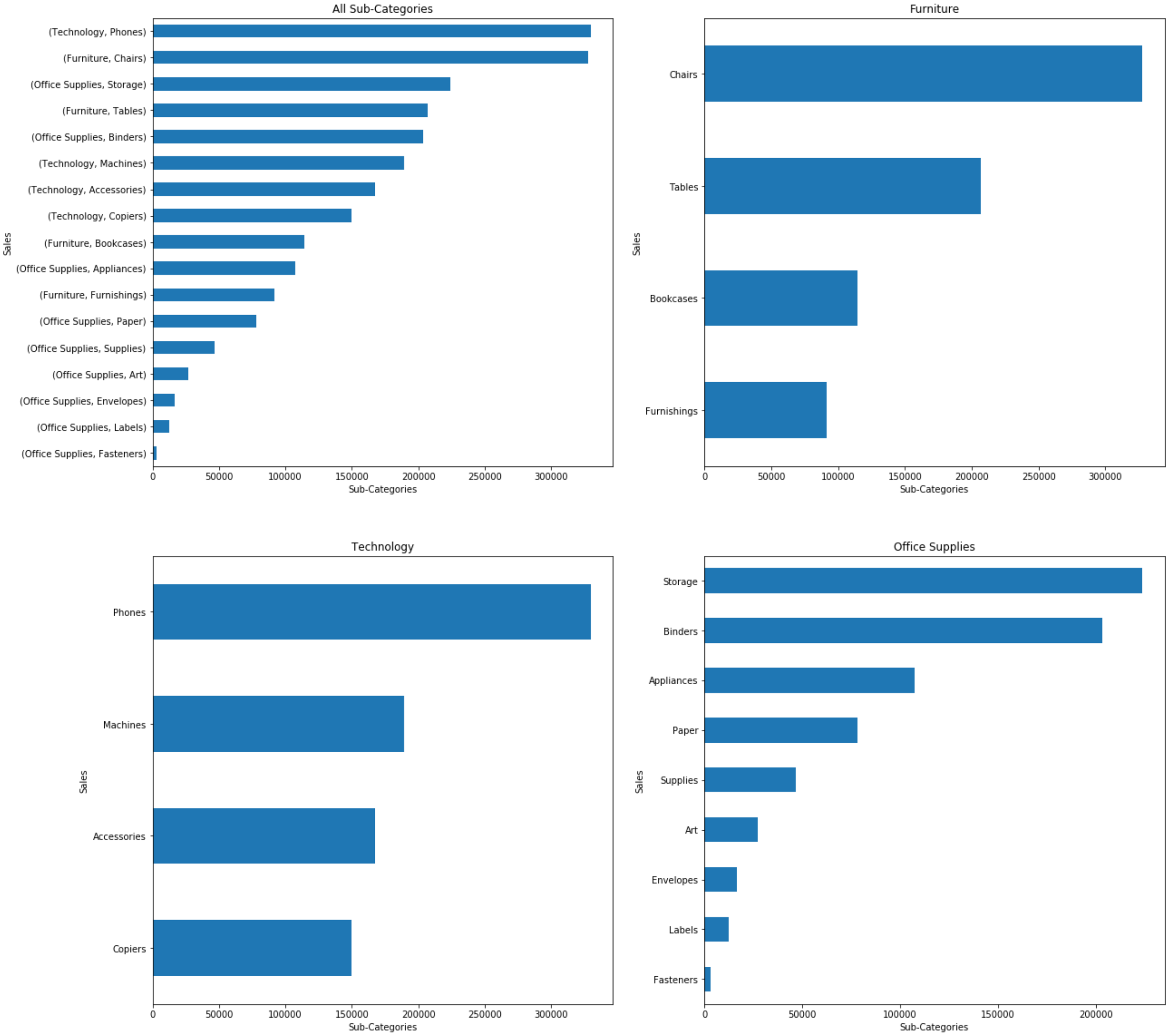
```
x=df.groupby(["Category","Sub-Category"]).Sales.sum()
y=df.groupby(["Category","Sub-Category"]).Profit.sum()
```

Sales

In [30]:

```
fig=plt.figure()
ax0=fig.add_subplot(2,2,1)
ax1=fig.add_subplot(2,2,2)
ax2=fig.add_subplot(2,2,3)
ax3=fig.add_subplot(2,2,4)

#Furniture
x["Furniture"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax1)
ax1.set_title("Furniture")
ax1.set_xlabel("Sub-Categories")
ax1.set_ylabel("Sales")

#Technology
x["Technology"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax2)
ax2.set_title("Technology")
ax2.set_xlabel("Sub-Categories")
ax2.set_ylabel("Sales")

#Office Supplies
x["Office Supplies"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax3)
ax3.set_title("Office Supplies")
ax3.set_xlabel("Sub-Categories")
ax3.set_ylabel("Sales")

#Total
x.sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax0)
ax0.set_title("All Sub-Categories")
ax0.set_xlabel("Sub-Categories")
ax0.set_ylabel("Sales")
```

```
Out[30]: Text(0, 0.5, 'Sales')
```



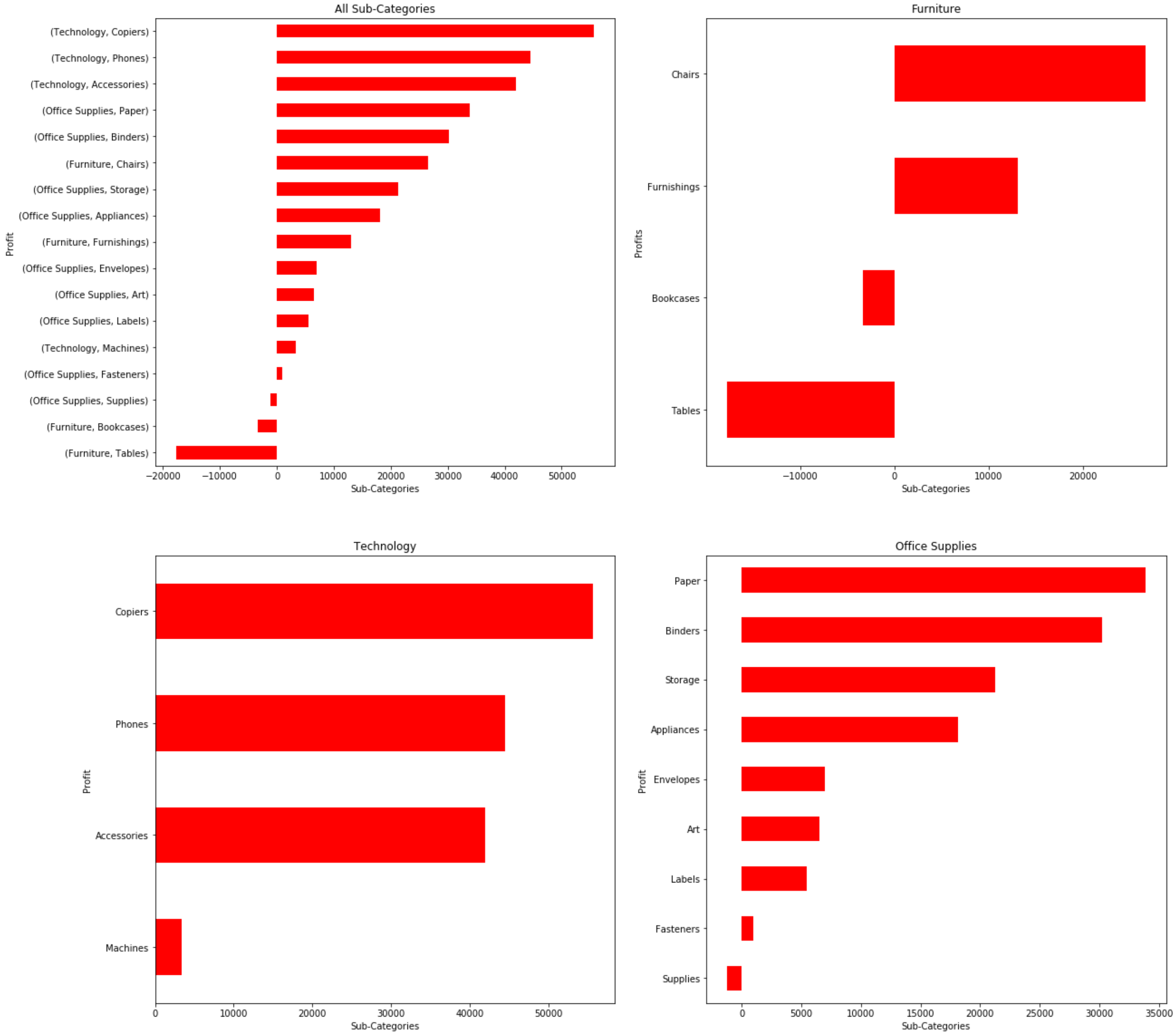
1. Maximum Sales in : Phones(Technology), Chairs(Furniture) and Storage(Office Supplies)
2. Minimum Sales in : Fasteners, Labels and Envelopes (Office Supplies)

Profit

In [31]:

```
fig=plt.figure()
ax0=fig.add_subplot(2,2,1)
ax1=fig.add_subplot(2,2,2)
ax2=fig.add_subplot(2,2,3)
ax3=fig.add_subplot(2,2,4)
#Furniture
y["Furniture"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax1,color="red")
ax1.set_title("Furniture")
ax1.set_xlabel("Sub-Categories")
ax1.set_ylabel("Profits")

#Technology
y["Technology"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax2,color="red")
ax2.set_title("Technology")
ax2.set_xlabel("Sub-Categories")
ax2.set_ylabel("Profit")

#Office Supplies
y["Office Supplies"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax3,color="red")
ax3.set_title("Office Supplies")
ax3.set_xlabel("Sub-Categories")
ax3.set_ylabel("Profit")

#Total
y.sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax0,color="red")
ax0.set_title("All Sub-Categories")
ax0.set_xlabel("Sub-Categories")
ax0.set_ylabel("Profit")
```

```
Out[31]: Text(0, 0.5, 'Profit')
```



1. Maximum Profit in : Copiers, Phones and Accessories (Technology)
2. Loss in : Tables and Bookcases (Furniture) and Supplies (Office Supplies)

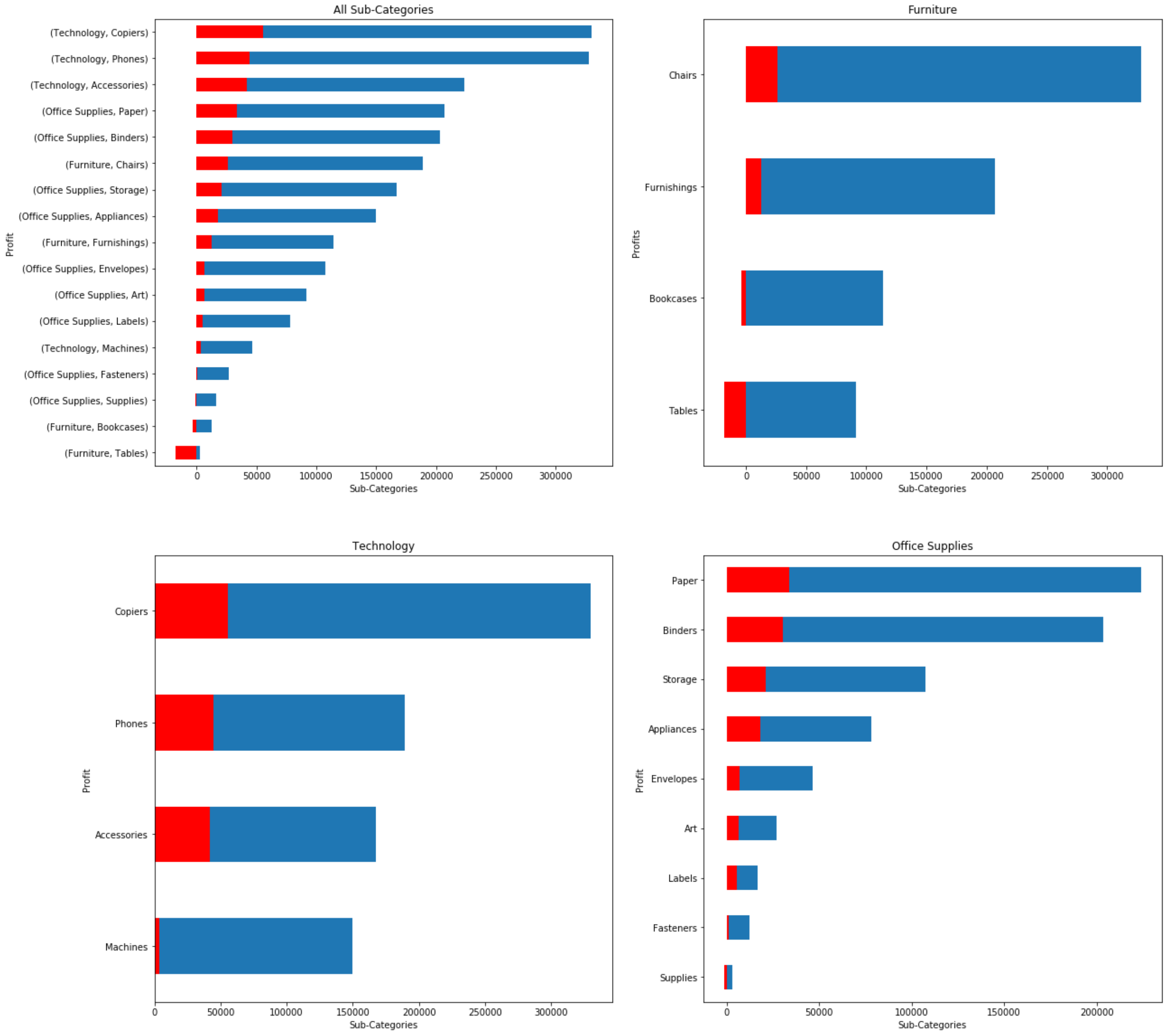
Sales and Profit Combined

In [32]:

```
#Sales

fig=plt.figure()
ax0=fig.add_subplot(2,2,1)
ax1=fig.add_subplot(2,2,2)
ax2=fig.add_subplot(2,2,3)
ax3=fig.add_subplot(2,2,4)

#Furniture
x["Furniture"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax
=ax1,)
ax1.set_title("Furniture")
ax1.set_xlabel("Sub-Categories")
ax1.set_ylabel("Sales")

#Technology
x["Technology"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),a
x=ax2)
ax2.set_title("Technology")
ax2.set_xlabel("Sub-Categories")
ax2.set_ylabel("Sales")

#Office Supplies
x["Office Supplies"].sort_values(ascending=True).plot(kind="barh", figsize=(20,
20),ax=ax3)
ax3.set_title("Office Supplies")
ax3.set_xlabel("Sub-Categories")
ax3.set_ylabel("Sales")

#Total
x.sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax0)
ax0.set_title("All Sub-Categories")
ax0.set_xlabel("Sub-Categories")
ax0.set_ylabel("Sales")

#Profit

#Furniture
y["Furniture"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax
=ax1,color="red")
ax1.set_title("Furniture")
ax1.set_xlabel("Sub-Categories")
ax1.set_ylabel("Profits")

#Technology
y["Technology"].sort_values(ascending=True).plot(kind="barh", figsize=(20,20),a
x=ax2,color="red")
ax2.set_title("Technology")
ax2.set_xlabel("Sub-Categories")
ax2.set_ylabel("Profit")

#Office Supplies
y["Office Supplies"].sort_values(ascending=True).plot(kind="barh", figsize=(20,
20),ax=ax3,color="red")
ax3.set_title("Office Supplies")
ax3.set_xlabel("Sub-Categories")
ax3.set_ylabel("Profit")
```

```
#Total
y.sort_values(ascending=True).plot(kind="barh", figsize=(20,20),ax=ax0,color="r
ed")
ax0.set_title("All Sub-Categories")
ax0.set_xlabel("Sub-Categories")
ax0.set_ylabel("Profit")
```

```
Out[32]: Text(0, 0.5, 'Profit')
```



1. Highest Sales and Profit in : Copiers, Phones and Accessories (Technology)
2. Lowest Sales and Profit in : Tables, Bookcases (Furniture) and Supplies (Office Supplies)

In [33]:

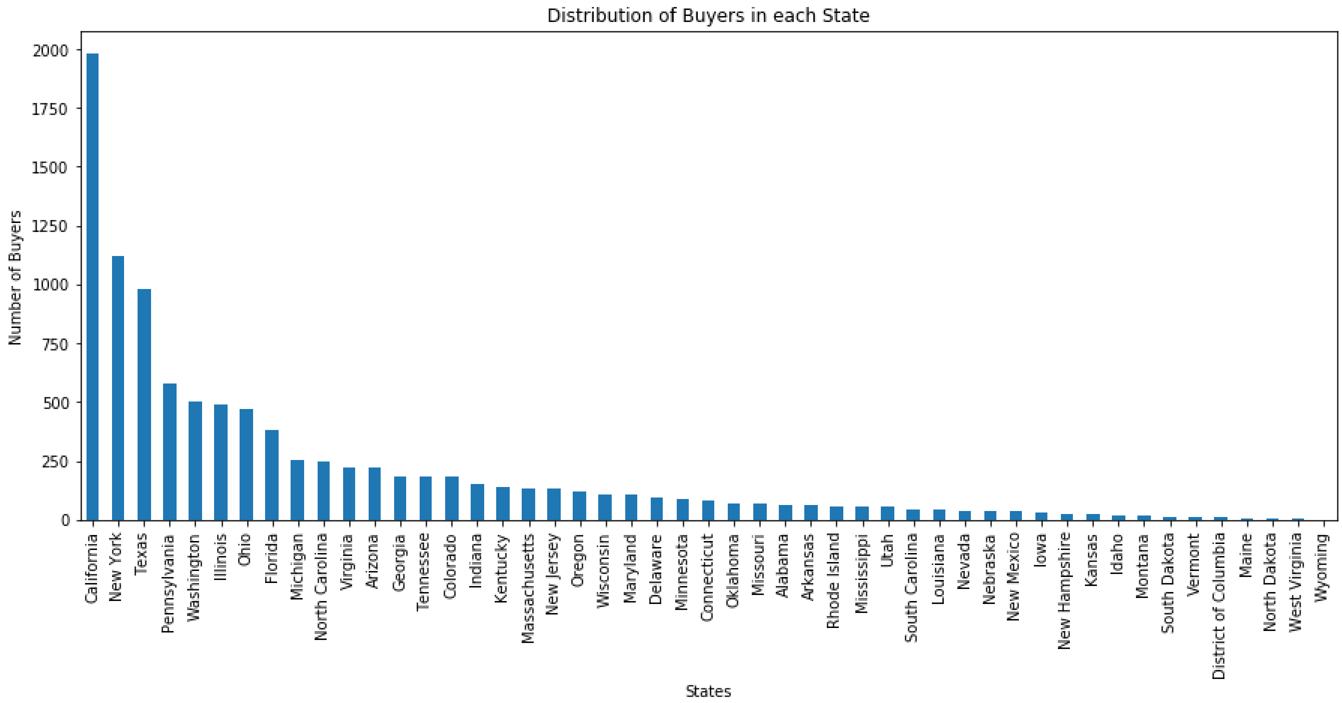
```
state=df["State"].value_counts()
state
```

Out[33]:

```
California              1980
New York                1119
Texas                    980
Pennsylvania             581
Washington               502
Illinois                 490
Ohio                     468
Florida                  383
Michigan                 254
North Carolina           249
Virginia                 224
Arizona                  224
Georgia                  184
Tennessee                183
Colorado                 182
Indiana                  149
Kentucky                 139
Massachusetts            135
New Jersey               130
Oregon                   123
Wisconsin                110
Maryland                 105
Delaware                  96
Minnesota                 89
Connecticut               82
Oklahoma                  66
Missouri                  66
Alabama                   61
Arkansas                  60
Rhode Island              56
Mississippi               53
Utah                      53
South Carolina            42
Louisiana                 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 [34]:
```
state.plot(kind="bar",figsize=(15,6))
plt.title("Distribution of Buyers in each State")
plt.xlabel("States")
plt.ylabel("Number of Buyers")
```

Out[34]:
```
Text(0, 0.5, 'Number of Buyers')
```



1. Most buyers belong to "California", "New York" and "Texas"
2. Least buyers belong to "Wyoming", "West Virginia" and "North Dakota"

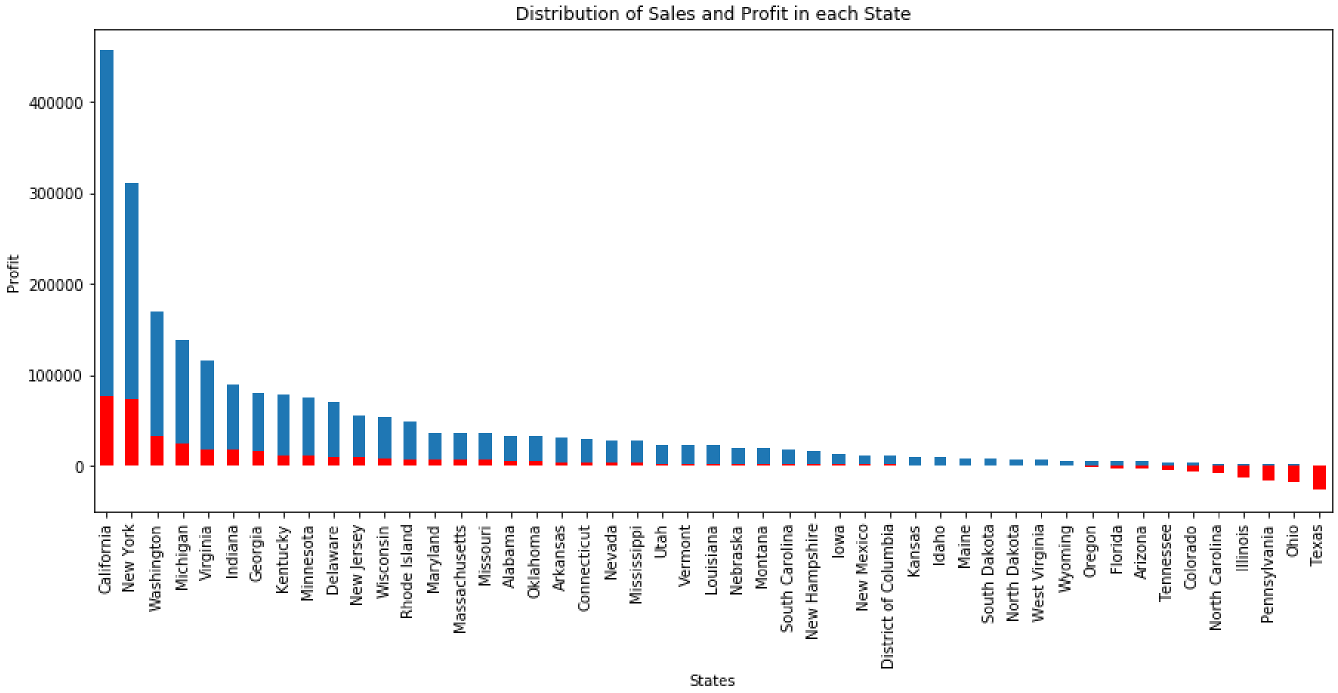
In [35]:
```
ss=df.groupby(["State"]).Sales.sum()
sp=df.groupby(["State"]).Profit.sum()
```

In [36]:

```
#State wise Distribution of Sales
ss.sort_values(ascending=False).plot(kind="bar",figsize=(15,6))
plt.xlabel("States")
plt.ylabel("Sales")

#State wise Distribution of Profit
sp.sort_values(ascending=False).sort_values(ascending=False).plot(kind="bar",figsize=(15,6),color="red")
plt.title("Distribution of Sales and Profit in each State")
plt.xlabel("States")
plt.ylabel("Profit")
```

Out[36]:

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



1. Maximum Sales and Profit in cities: "California" and "New York"
2. Minimum Sales and Profit in cities: "Oregon", "Florida" , "Arizona", "Tennessee", "Colorado", "North Carolina", "Ilionis", "Pennsylvania", "Ohio" and "Texas"

Segment

In [37]:

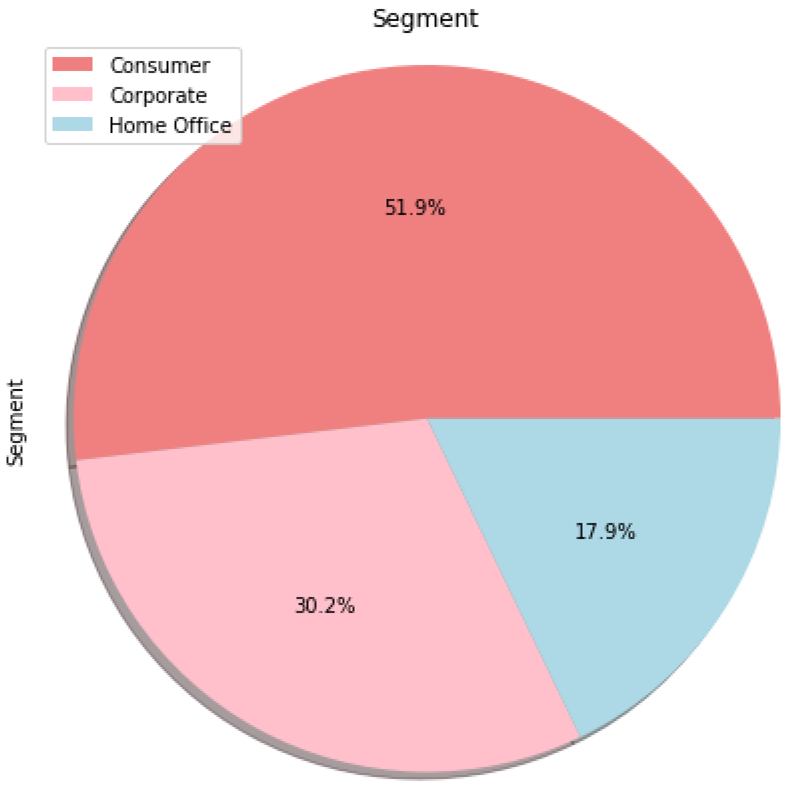
```
seg=df["Segment"].value_counts()
seg
```

Out[37]:

```
Consumer       5160
Corporate      3008
Home Office    1776
Name: Segment, dtype: int64
```

In [38]:

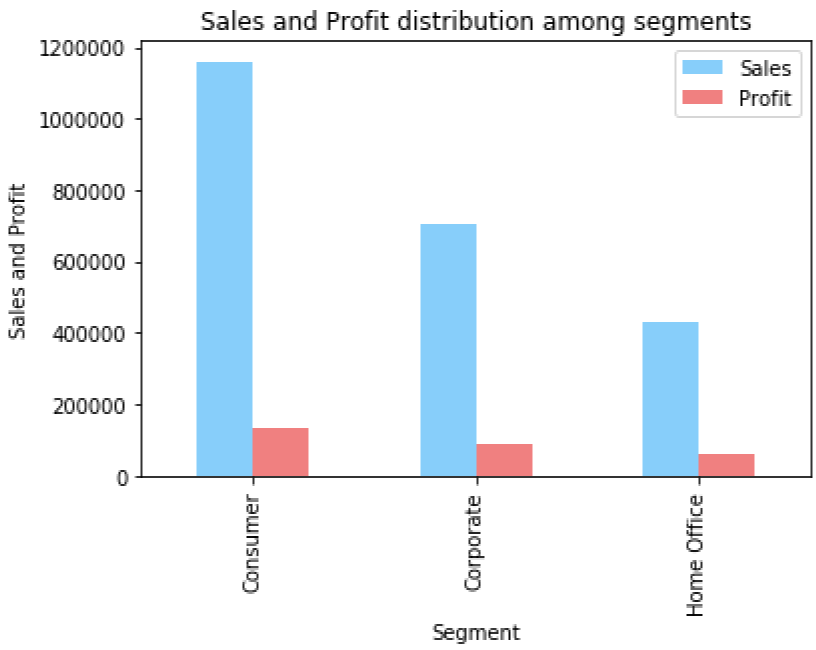
```
seg.plot(kind="pie",figsize=(7,7),autopct="%1.1f%%",
         shadow=True,labels=None,colors=["lightcoral","pink","lightblue"])
plt.title("Segment")
plt.legend(labels=seg.index,loc="upper left")
plt.axis("equal")
plt.show()
```



Major business distribution in Consumer Segment and Least in Home Office

Sales and Profit in different segments

In [39]:
```
df.groupby("Segment")[["Sales","Profit"]].sum().plot(kind="bar",color=["lightsk
yblue","lightcoral"])
plt.ylabel("Sales and Profit")
plt.xlabel("Segment")
plt.title("Sales and Profit distribution among segments")
plt.show()
```



Most Profit and Sales in Consumer segment and least in Home Office

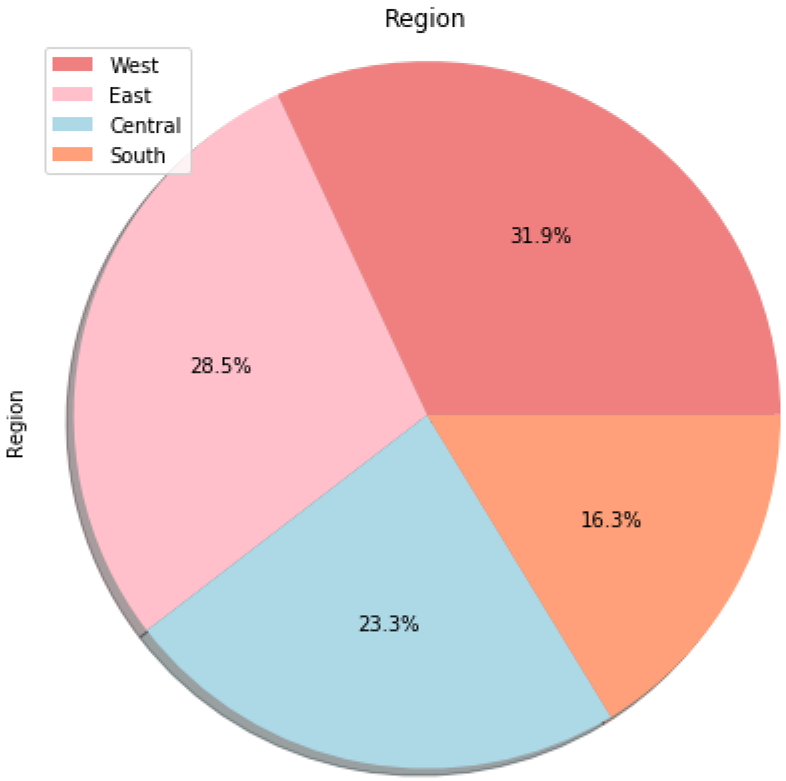
Region

In [40]:
```
reg=df["Region"].value_counts()
reg
```

Out[40]:
```
West       3177
East       2832
Central    2315
South      1620
Name: Region, dtype: int64
```

In [41]:

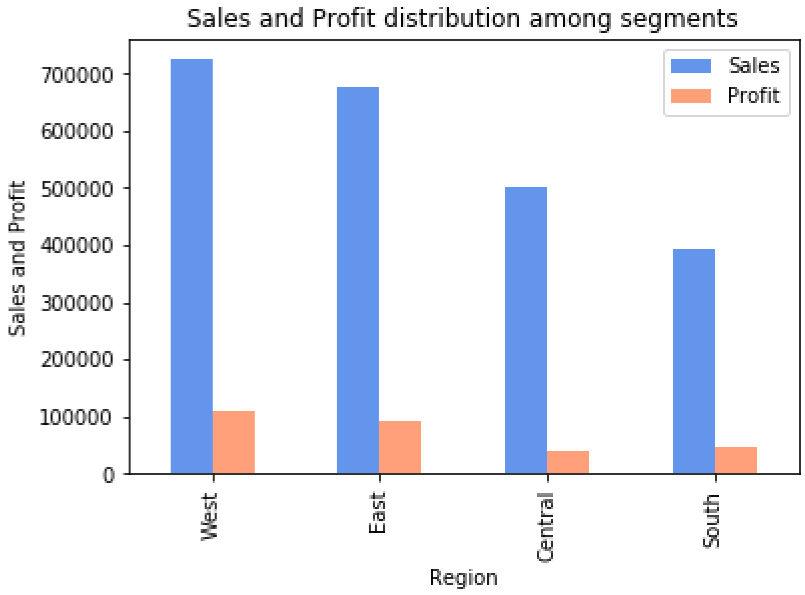
```
reg.plot(kind="pie",figsize=(7,7),autopct="%1.1f%%",
         shadow=True,labels=None, colors=["lightcoral","pink","lightblue","lightsalmon"])
plt.title("Region")
plt.legend(labels=reg.index,loc="upper left")
plt.axis("equal")
plt.show()
```



Company deals majorly in Western Region and least in Southern Region

In [42]:

```
df.groupby("Region")[["Sales","Profit"]].sum().sort_values(by=["Sales","Profit"],ascending=False).plot(kind="bar",color=["cornflowerblue","lightsalmon"])
plt.ylabel("Sales and Profit")
plt.xlabel("Region")
plt.title("Sales and Profit distribution among segments")
plt.show()
```

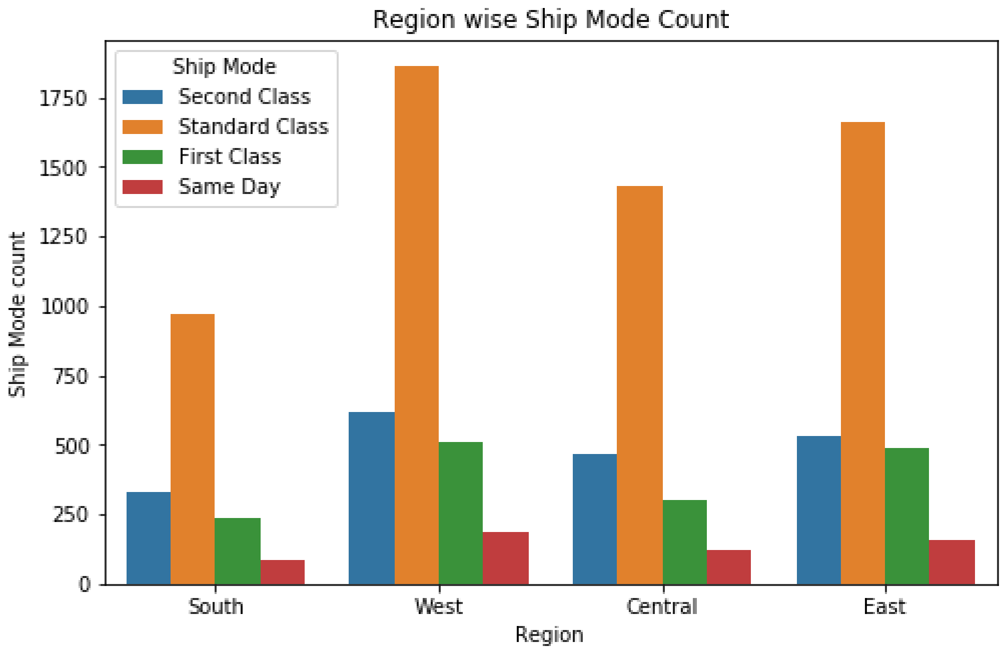


More Profit from Western and Eastern Regions whereas lesser profits from Central and Southern regions

Region wise Ship Mode

In [43]:

```
plt.figure(figsize=(8,5))
sns.countplot(x="Region", hue="Ship Mode", data=df)
plt.title("Region wise Ship Mode Count")
plt.ylabel("Ship Mode count")
plt.show()
```



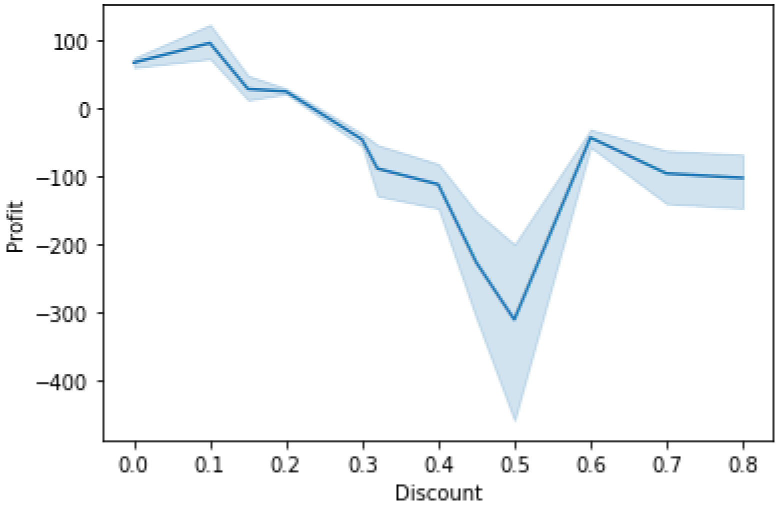
1. Most opted mode : Standard Class and
2. Least opted mode: Same Day

Relation between Profit and Discount

```
In [44]: df["Discount"].corr(df["Profit"])
```

```
Out[44]: -0.21993898249765056
```

```
In [45]: sns.lineplot(x="Discount",y="Profit",data=df)
         plt.show()
```

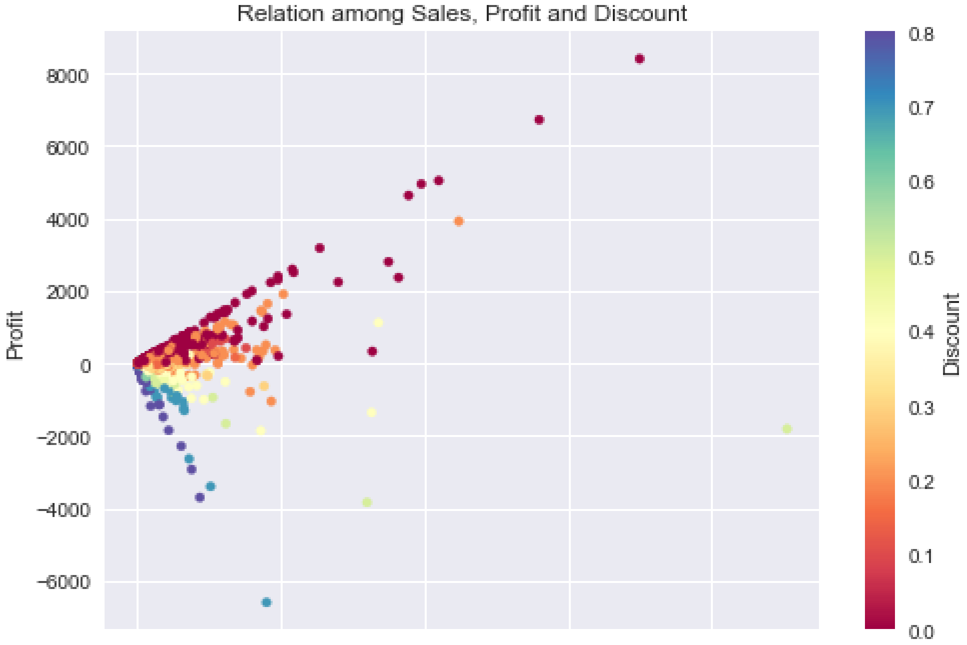


Profit and Discount have negative relation,i.e, when one increases the other decreases

Relation among Sales, Profit and Discount

In [46]:

```
plt.style.use("seaborn")
df.plot(kind="scatter",x="Sales",y="Profit",c="Discount",colormap="Spectral")
plt.xlabel("Sales")
plt.ylabel("Profit")
plt.title("Relation among Sales, Profit and Discount")
plt.show()
```



1. As Discount increases Profit decreases
2. Discount and Sales have a lesser relation but Sales also decrease with increasing discount

Thank You!!!

In [ ]:

```
```