In [ ]:

```
# Import Libraries
import pandas as pd, numpy as np, matplotlib.pyplot as plt, seaborn as sns
%matplotlib inline
```

In [ ]:

```
# Read the csv files from my local directory
file = "Sales Data.csv"
df = pd.read_csv(file)
```

In [ ]:

```
# Few the first 10 rows
df.head(10)
```

Out[ ]:

	Unnamed: 0	Order ID	Product	Quantity Ordered	Price Each	Order Date	Purchase Address	Month	Sales	City	Hour
0	0	295665	Macbook Pro Laptop	1	1700.00	2019-12-30 00:01:00	136 Church St, New York City, NY 10001	12	1700.00	New York City	0
1	1	295666	LG Washing Machine	1	600.00	2019-12-29 07:03:00	562 2nd St, New York City, NY 10001	12	600.00	New York City	7
2	2	295667	USB-C Charging Cable	1	11.95	2019-12-12 18:21:00	277 Main St, New York City, NY 10001	12	11.95	New York City	18
3	3	295668	27in FHD Monitor	1	149.99	2019-12-22 15:13:00	410 6th St, San Francisco, CA 94016	12	149.99	San Francisco	15
4	4	295669	USB-C Charging Cable	1	11.95	2019-12-18 12:38:00	43 Hill St, Atlanta, GA 30301	12	11.95	Atlanta	12
5	5	295670	AA Batteries (4-pack)	1	3.84	2019-12-31 22:58:00	200 Jefferson St, New York City, NY 10001	12	3.84	New York City	22
6	6	295671	USB-C Charging Cable	1	11.95	2019-12-16 15:10:00	928 12th St, Portland, OR 97035	12	11.95	Portland	15
7	7	295672	USB-C Charging Cable	2	11.95	2019-12-13 09:29:00	813 Hickory St, Dallas, TX 75001	12	23.90	Dallas	9
8	8	295673	Bose SoundSport Headphones	1	99.99	2019-12-15 23:26:00	718 Wilson St, Dallas, TX 75001	12	99.99	Dallas	23
9	9	295674	AAA Batteries (4-pack)	4	2.99	2019-12-28 11:51:00	77 7th St, Dallas, TX 75001	12	11.96	Dallas	11

Data Cleaning and Wrangling

In [ ]:

```
# The number of rows and columns in the dataset
df.shape
```

Out[ ]:

```
(185950, 11)
```

In [ ]:

```
# Statistical analysis of numericial columns in the dataset
df.describe()
```

Out[ ]:

	Unnamed: 0	Order ID	Quantity Ordered	Price Each	Month	Sales	Hour
count	185950.000000	185950.000000	185950.000000	185950.000000	185950.000000	185950.000000	185950.000000
mean	8340.388475	230417.569379	1.124383	184.399735	7.059140	185.490917	14.413305
std	5450.554093	51512.737110	0.442793	332.731330	3.502996	332.919771	5.423416
min	0.000000	141234.000000	1.000000	2.990000	1.000000	2.990000	0.000000
25%	3894.000000	185831.250000	1.000000	11.950000	4.000000	11.950000	11.000000
50%	7786.000000	230367.500000	1.000000	14.950000	7.000000	14.950000	15.000000
75%	11872.000000	275035.750000	1.000000	150.000000	10.000000	150.000000	19.000000
max	25116.000000	319670.000000	9.000000	1700.000000	12.000000	3400.000000	23.000000

In [ ]:

```
# The data type of each column in the dataset
df.dtypes
```

```
Out[ ]: Unnamed: 0            int64
        Order ID              int64
        Product              object
        Quantity Ordered      int64
        Price Each          float64
        Order Date           object
        Purchase Address     object
        Month                 int64
        Sales               float64
        City                 object
        Hour                  int64
        dtype: object
```

```
In [ ]: # Get further info on each column and count non-null values
        df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 185950 entries, 0 to 185949
Data columns (total 11 columns):
 #   Column            Non-Null Count   Dtype  
---  ------            --------------   -----  
 0   Unnamed: 0        185950 non-null  int64  
 1   Order ID          185950 non-null  int64  
 2   Product           185950 non-null  object 
 3   Quantity Ordered  185950 non-null  int64  
 4   Price Each        185950 non-null  float64
 5   Order Date        185950 non-null  object 
 6   Purchase Address  185950 non-null  object 
 7   Month             185950 non-null  int64  
 8   Sales             185950 non-null  float64
 9   City              185950 non-null  object 
 10  Hour              185950 non-null  int64  
dtypes: float64(2), int64(5), object(4)
memory usage: 15.6+ MB
```

```
In [ ]: # Check if there is a null value in the entire dataset
        df.isna().values.any()
```

```
Out[ ]: False
```

```
In [ ]: # Check for the number of non value
```

```
df.isna().sum()
```

```
Out[ ]: Unnamed: 0          0
        Order ID            0
        Product             0
        Quantity Ordered    0
        Price Each          0
        Order Date          0
        Purchase Address    0
        Month               0
        Sales               0
        City                0
        Hour                0
        dtype: int64
```

```
In [ ]: # List out all Columns in the dataset
        df.columns
```

```
Out[ ]: Index(['Unnamed: 0', 'Order ID', 'Product', 'Quantity Ordered', 'Price Each',
               'Order Date', 'Purchase Address', 'Month', 'Sales', 'City', 'Hour'],
              dtype='object')
```

```
In [ ]: # Drop the column 'Unnamed: 0'
        df = df.drop(columns=['Unnamed: 0'])
        df.columns
```

```
Out[ ]: Index(['Order ID', 'Product', 'Quantity Ordered', 'Price Each', 'Order Date',
               'Purchase Address', 'Month', 'Sales', 'City', 'Hour'],
              dtype='object')
```

```
In [ ]: # Split the Order Date into two columns
        df[['Order Date', 'Order Time']] = df['Order Date'].str.split(' ', expand=True)
        df[['Order Date', 'Order Time']].head()
```

Out[ ]:

	Order Date	Order Time
0	2019-12-30	00:01:00
1	2019-12-29	07:03:00
2	2019-12-12	18:21:00
3	2019-12-22	15:13:00
4	2019-12-18	12:38:00

In [ ]:

```python
# strip off :00 from the Order Time
df['Order Time'] = df['Order Time'].str.rstrip(":00")
df['Order Time'].head()
```

Out[ ]:

```
0    00:01
1    07:03
2    18:21
3    15:13
4    12:38
Name: Order Time, dtype: object
```

In [ ]:

```python
# replace 00:01 to 01:00
for row in df.index:
    if df.loc[row, 'Order Time'] == '00:01':
        df.loc[row, 'Order Time'] = '01:00'

df['Order Time'].head()
```

Out[ ]:

```
0    01:00
1    07:03
2    18:21
3    15:13
4    12:38
Name: Order Time, dtype: object
```

In [ ]:

```python
# Convert the order time column to datetime type
df['Order Date'] = pd.to_datetime(df['Order Date'])
df['Order Date'] = df['Order Date']
df['Order Date'].head()
```

```
Out[ ]: 0   2019-12-30
        1   2019-12-29
        2   2019-12-12
        3   2019-12-22
        4   2019-12-18
        Name: Order Date, dtype: datetime64[ns]
```

```
In [ ]: # strip out unwanted space in the City column
        df["City"] = df["City"].str.strip(" ")
```

```
In [ ]: # Create a new dataset with subset
        df_new = df[['Order ID', 'Order Date', 'Order Time', 'Product', 'Quantity Ordered', 'Price Each', 'Sales', 'Purchase
```

```
In [ ]: # View first 10 rows
        df_new.head(10)
```

Out[ ]:

	Order ID	Order Date	Order Time	Product	Quantity Ordered	Price Each	Sales	Purchase Address	City
0	295665	2019-12-30	01:00	Macbook Pro Laptop	1	1700.00	1700.00	136 Church St, New York City, NY 10001	New York City
1	295666	2019-12-29	07:03	LG Washing Machine	1	600.00	600.00	562 2nd St, New York City, NY 10001	New York City
2	295667	2019-12-12	18:21	USB-C Charging Cable	1	11.95	11.95	277 Main St, New York City, NY 10001	New York City
3	295668	2019-12-22	15:13	27in FHD Monitor	1	149.99	149.99	410 6th St, San Francisco, CA 94016	San Francisco
4	295669	2019-12-18	12:38	USB-C Charging Cable	1	11.95	11.95	43 Hill St, Atlanta, GA 30301	Atlanta
5	295670	2019-12-31	22:58	AA Batteries (4-pack)	1	3.84	3.84	200 Jefferson St, New York City, NY 10001	New York City
6	295671	2019-12-16	15:1	USB-C Charging Cable	1	11.95	11.95	928 12th St, Portland, OR 97035	Portland
7	295672	2019-12-13	09:29	USB-C Charging Cable	2	11.95	23.90	813 Hickory St, Dallas, TX 75001	Dallas
8	295673	2019-12-15	23:26	Bose SoundSport Headphones	1	99.99	99.99	718 Wilson St, Dallas, TX 75001	Dallas
9	295674	2019-12-28	11:51	AAA Batteries (4-pack)	4	2.99	11.96	77 7th St, Dallas, TX 75001	Dallas

Exploratory Data Analysis

Here are some case studies for you to consider.

How many unique goods did the business sell overall?

In [ ]:

```
total_product_sold = df_new['Product'].nunique()
print(f"The number of distinctive products sold by the company is {total_product_sold}")
```

```
The number of distinctive products sold by the company is 19
```

List all the standout items the business sells.

In [ ]:
```
product_list = df_new['Product'].drop_duplicates().reset_index(drop=True)
product_list.index+=1
product_list
```

Out[ ]:
```
1                   Macbook Pro Laptop
2                   LG Washing Machine
3                 USB-C Charging Cable
4                     27in FHD Monitor
5                AA Batteries (4-pack)
6           Bose SoundSport Headphones
7               AAA Batteries (4-pack)
8                     ThinkPad Laptop
9              Lightning Charging Cable
10                        Google Phone
11                    Wired Headphones
12            Apple Airpods Headphones
13                      Vareebadd Phone
14                              iPhone
15                        20in Monitor
16              34in Ultrawide Monitor
17                       Flatscreen TV
18              27in 4K Gaming Monitor
19                            LG Dryer
Name: Product, dtype: object
```

How much does each product cost?

In [ ]:
```
price_of_each_product = df_new[['Product', 'Price Each']].sort_values('Price Each', ascending=False)\
                                                          .drop_duplicates()\
                                                          .reset_index(drop=True)

price_of_each_product.columns = ['Product', 'Price']
price_of_each_product.index +=1
price_of_each_product
```

Out[ ]:

	Product	Price
1	Macbook Pro Laptop	1700.00
2	ThinkPad Laptop	999.99
3	iPhone	700.00
4	Google Phone	600.00
5	LG Dryer	600.00
6	LG Washing Machine	600.00
7	Vareebadd Phone	400.00
8	27in 4K Gaming Monitor	389.99
9	34in Ultrawide Monitor	379.99
10	Flatscreen TV	300.00
11	Apple Airpods Headphones	150.00
12	27in FHD Monitor	149.99
13	20in Monitor	109.99
14	Bose SoundSport Headphones	99.99
15	Lightning Charging Cable	14.95
16	Wired Headphones	11.99
17	USB-C Charging Cable	11.95
18	AA Batteries (4-pack)	3.84
19	AAA Batteries (4-pack)	2.99

How many of each product did the business sell in total?

In [ ]:

```
unit_sold_for_each_product = df_new.groupby('Product')['Quantity Ordered'].sum()\
                                    .reset_index()\
                                    .sort_values('Quantity Ordered', ascending=False)\
                                    .reset_index(drop=True)

unit_sold_for_each_product.columns = ['Product', 'Total Qty Ordered']
unit_sold_for_each_product.index += 1
unit_sold_for_each_product
```

Out[ ]:

	Product	Total Qty Ordered
1	AAA Batteries (4-pack)	31017
2	AA Batteries (4-pack)	27635
3	USB-C Charging Cable	23975
4	Lightning Charging Cable	23217
5	Wired Headphones	20557
6	Apple Airpods Headphones	15661
7	Bose SoundSport Headphones	13457
8	27in FHD Monitor	7550
9	iPhone	6849
10	27in 4K Gaming Monitor	6244
11	34in Ultrawide Monitor	6199
12	Google Phone	5532
13	Flatscreen TV	4819
14	Macbook Pro Laptop	4728
15	ThinkPad Laptop	4130
16	20in Monitor	4129
17	Vareebadd Phone	2068
18	LG Washing Machine	666
19	LG Dryer	646

What was the total amount of merchandise sold?

In [ ]:

```
total_qty = df_new['Quantity Ordered'].sum()
print(f'The total quantity ordered for all product is ${total_qty}')
```

```
The total quantity ordered for all product is $209079
```

What percentage of each product's overall sales?

```
In [ ]: total_qty_sales = df_new.groupby(['Product','Price Each'])[['Quantity Ordered','Sales']].sum()
        total_qty_sales.columns=['Total Qty Ord', 'Total Sales']
        total_qty_sales.sort_values('Total Sales',ascending=False)
```

Out[ ]:

		Total Qty Ord	Total Sales
Product	**Price Each**		
Macbook Pro Laptop	**1700.00**	4728	8037600.00
iPhone	**700.00**	6849	4794300.00
ThinkPad Laptop	**999.99**	4130	4129958.70
Google Phone	**600.00**	5532	3319200.00
27in 4K Gaming Monitor	**389.99**	6244	2435097.56
34in Ultrawide Monitor	**379.99**	6199	2355558.01
Apple Airpods Headphones	**150.00**	15661	2349150.00
Flatscreen TV	**300.00**	4819	1445700.00
Bose SoundSport Headphones	**99.99**	13457	1345565.43
27in FHD Monitor	**149.99**	7550	1132424.50
Vareebadd Phone	**400.00**	2068	827200.00
20in Monitor	**109.99**	4129	454148.71
LG Washing Machine	**600.00**	666	399600.00
LG Dryer	**600.00**	646	387600.00
Lightning Charging Cable	**14.95**	23217	347094.15
USB-C Charging Cable	**11.95**	23975	286501.25
Wired Headphones	**11.99**	20557	246478.43
AA Batteries (4-pack)	**3.84**	27635	106118.40
AAA Batteries (4-pack)	**2.99**	31017	92740.83

In [ ]:

```
total_qty_sales['Percentage Sales'] = round((total_qty_sales['Total Sales'] / total_qty_sales['Total Sales'].sum()) *
In [ ]: total_qty_sales.sort_values('Percentage Sales',ascending=False)
```

Out[ ]:

		Total Qty Ord	Total Sales	Percentage Sales
Product	**Price Each**			
Macbook Pro Laptop	**1700.00**	4728	8037600.00	23.30
iPhone	**700.00**	6849	4794300.00	13.90
ThinkPad Laptop	**999.99**	4130	4129958.70	11.97
Google Phone	**600.00**	5532	3319200.00	9.62
27in 4K Gaming Monitor	**389.99**	6244	2435097.56	7.06
34in Ultrawide Monitor	**379.99**	6199	2355558.01	6.83
Apple Airpods Headphones	**150.00**	15661	2349150.00	6.81
Flatscreen TV	**300.00**	4819	1445700.00	4.19
Bose SoundSport Headphones	**99.99**	13457	1345565.43	3.90
27in FHD Monitor	**149.99**	7550	1132424.50	3.28
Vareebadd Phone	**400.00**	2068	827200.00	2.40
20in Monitor	**109.99**	4129	454148.71	1.32
LG Washing Machine	**600.00**	666	399600.00	1.16
LG Dryer	**600.00**	646	387600.00	1.12
Lightning Charging Cable	**14.95**	23217	347094.15	1.01
USB-C Charging Cable	**11.95**	23975	286501.25	0.83
Wired Headphones	**11.99**	20557	246478.43	0.71
AA Batteries (4-pack)	**3.84**	27635	106118.40	0.31
AAA Batteries (4-pack)	**2.99**	31017	92740.83	0.27

How much money was generated in total sales of all products?

In [ ]:

```
total_sales = df_new['Sales'].sum()
print(f'The total sales amount for all product is ${total_sales}')
```

```
The total sales amount for all product is $34492035.97
```

How many cities did the corporation sell its products in total?

In [ ]:

```
df_new['City'].nunique()
```

Out[ ]:

```
9
```

List every city where sales were made.

In [ ]:

```
cities_list = []
for city in df_new['City'].unique():
    cities_list.append(city)

cities_list = pd.Series(cities_list)

cities_list.index+=1
cities_list.name = "List of Cities Sales where made by the Company"
cities_list
```

Out[ ]:

```
1    New York City
2    San Francisco
3          Atlanta
4         Portland
5           Dallas
6      Los Angeles
7           Boston
8           Austin
9          Seattle
Name: List of Cities Sales where made by the Company, dtype: object
```

Which city generated the most revenue?

In [ ]:

```
top_city_sales = df_new.groupby('City')['Sales'].sum()\
                        .reset_index()\
                        .sort_values('Sales',ascending=False)\
                        .reset_index(drop=True)\
                           .head(1)

top_city_sales.index += 1
top_city_sales
```

Out[ ]:

	City	Sales
1	San Francisco	8262203.91

What are the top three and least popular items in the city?

In [ ]:
```
top3_product_top_city_sales = df_new.query("City == 'San Francisco'")\
                                        .groupby(['Product'])[['Quantity Ordered','Sales']].sum()\
                                        .reset_index()\
                                        .sort_values('Sales',ascending=False)\
                                        .reset_index(drop=True)

top3_product_top_city_sales.index += 1
top3_product_top_city_sales.head(3)
```

Out[ ]:

	Product	Quantity Ordered	Sales
1	Macbook Pro Laptop	1136	1931200.00
2	iPhone	1661	1162700.00
3	ThinkPad Laptop	963	962990.37

In [ ]:
```
# The least popular goods in that City
top3_product_top_city_sales.tail(1)
```

Out[ ]:

	Product	Quantity Ordered	Sales
19	AAA Batteries (4-pack)	7408	22149.92

Which city generated the least revenue?

In [ ]:
```
low_city_sales = df_new.groupby('City')['Sales'].sum()\
                           .reset_index()\
                           .sort_values('Sales')\
                           .reset_index(drop=True)\
                           .head(1)

low_city_sales.index += 1
low_city_sales
```

Out[ ]:

	City	Sales
1	Austin	1819581.75

What were the top three and the least popular goods in that city?

In [ ]:

```
top_product_low_city_sales = df_new.query("City == 'Austin'")\
                                    .groupby(['Product'])['Sales'].sum()\
                                    .reset_index()\
                                    .sort_values('Sales',ascending=False)\
                                    .reset_index(drop=True)

top_product_low_city_sales.index += 1
top_product_low_city_sales.head(3)
```

Out[ ]:

	Product	Sales
1	Macbook Pro Laptop	426700.0
2	iPhone	263900.0
3	ThinkPad Laptop	209997.9

In [ ]:

```
# The least popular goods in that City
top_product_low_city_sales.tail(1)
```

Out[ ]:

	Product	Sales
19	AAA Batteries (4-pack)	4987.32

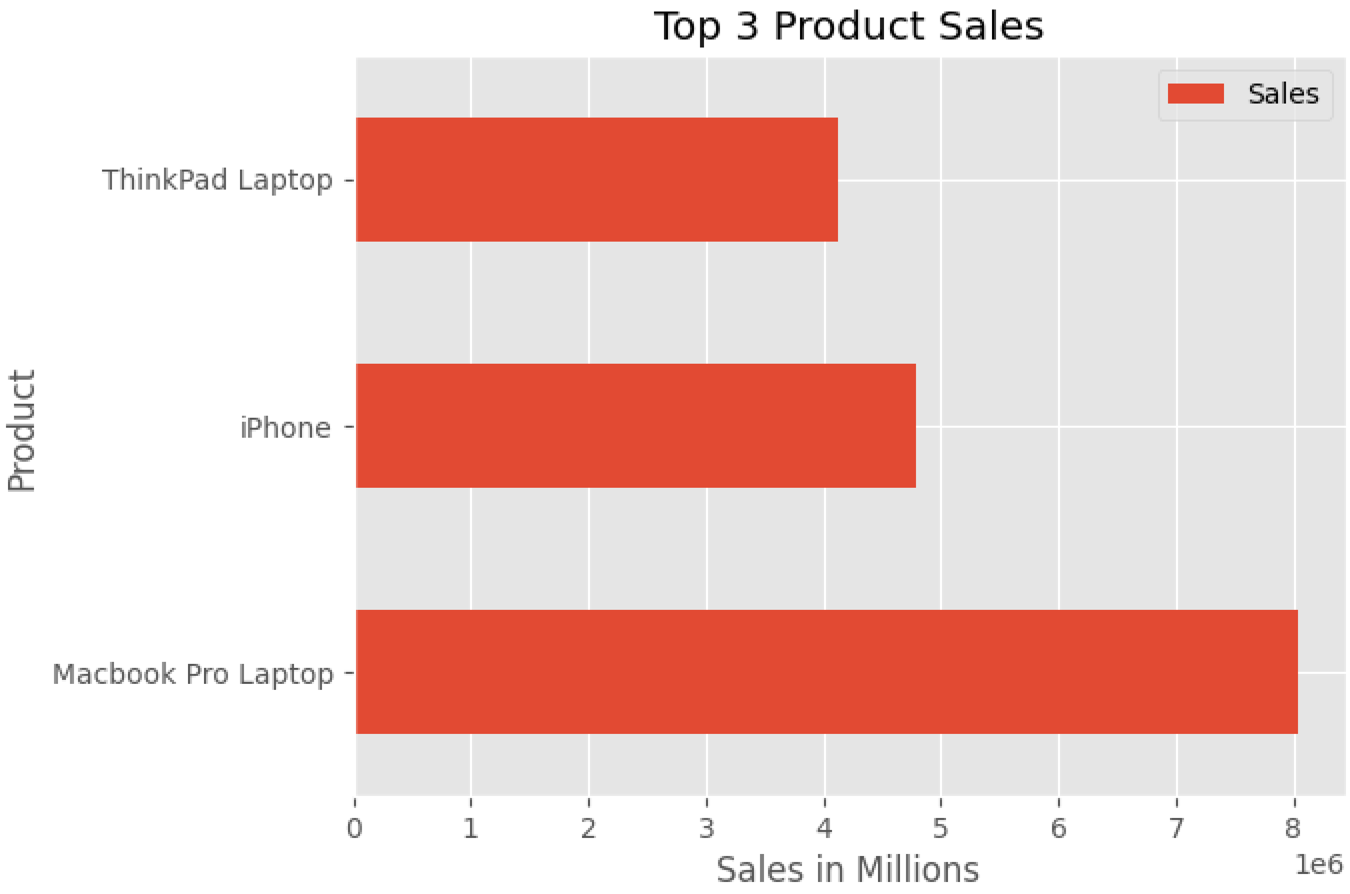
Opinion: Examine and analyze the product that, based on sales, you believe to be the most lucrative.

```
In [ ]: plt.style.use('ggplot')
```

```
In [ ]: top3_product_sales = df_new.groupby('Product')['Sales'].sum().reset_index().sort_values('Sales',ascending=False).rese
```

```
In [ ]: plt.figure(figsize=(5,5))
        top3_product_sales.set_index('Product').plot(kind='barh')
        plt.title("Top 3 Product Sales")
        plt.xlabel("Sales in Millions")
        plt.show()
```

```
<Figure size 500x500 with 0 Axes>
```



Macbook Pro Laptop Analysis

In [ ]:
```
mac = df_new[df_new['Product'] == 'Macbook Pro Laptop'].groupby('City')[['Quantity Ordered','Sales']].sum().reset_in
```

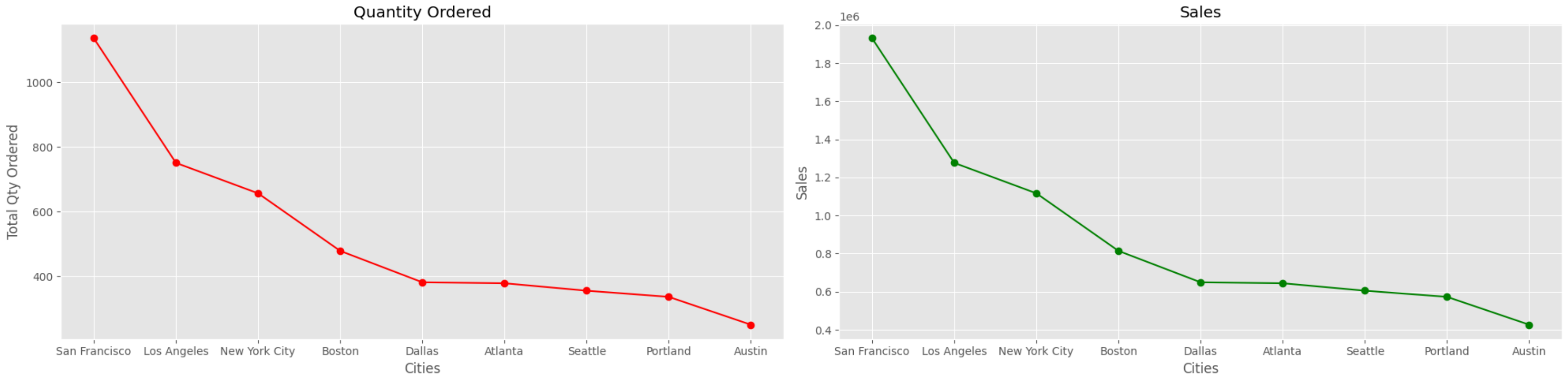
In [ ]:
```
mac = mac.sort_values('Sales', ascending=False).reset_index(drop=True)
mac.index += 1
mac
```

Out[ ]:

	City	Quantity Ordered	Sales
1	San Francisco	1136	1931200.0
2	Los Angeles	751	1276700.0
3	New York City	657	1116900.0
4	Boston	479	814300.0
5	Dallas	382	649400.0
6	Atlanta	379	644300.0
7	Seattle	356	605200.0
8	Portland	337	572900.0
9	Austin	251	426700.0

In [ ]:
```
fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(20, 5))

# First subplot (Quantity Ordered)
ax1.plot(mac['City'], mac['Quantity Ordered'], marker='o', color='red')
ax1.set_xlabel('Cities')
ax1.set_ylabel('Total Qty Ordered')
ax1.set_title('Quantity Ordered')

# Second subplot (Sales)
ax2.plot(mac['City'], mac['Sales'], marker='o', color='green')
ax2.set_xlabel('Cities')
ax2.set_ylabel('Sales')
ax2.set_title('Sales')

# Adjust layout for better spacing
plt.tight_layout()
```

```
# Show the subplots
plt.show()
```



In [ ]:

```
mac2 = df_new[df_new['Product'] == 'Macbook Pro Laptop'].groupby('Order Date')['Sales'].sum()
mac2.head(10)
```

Out[ ]:

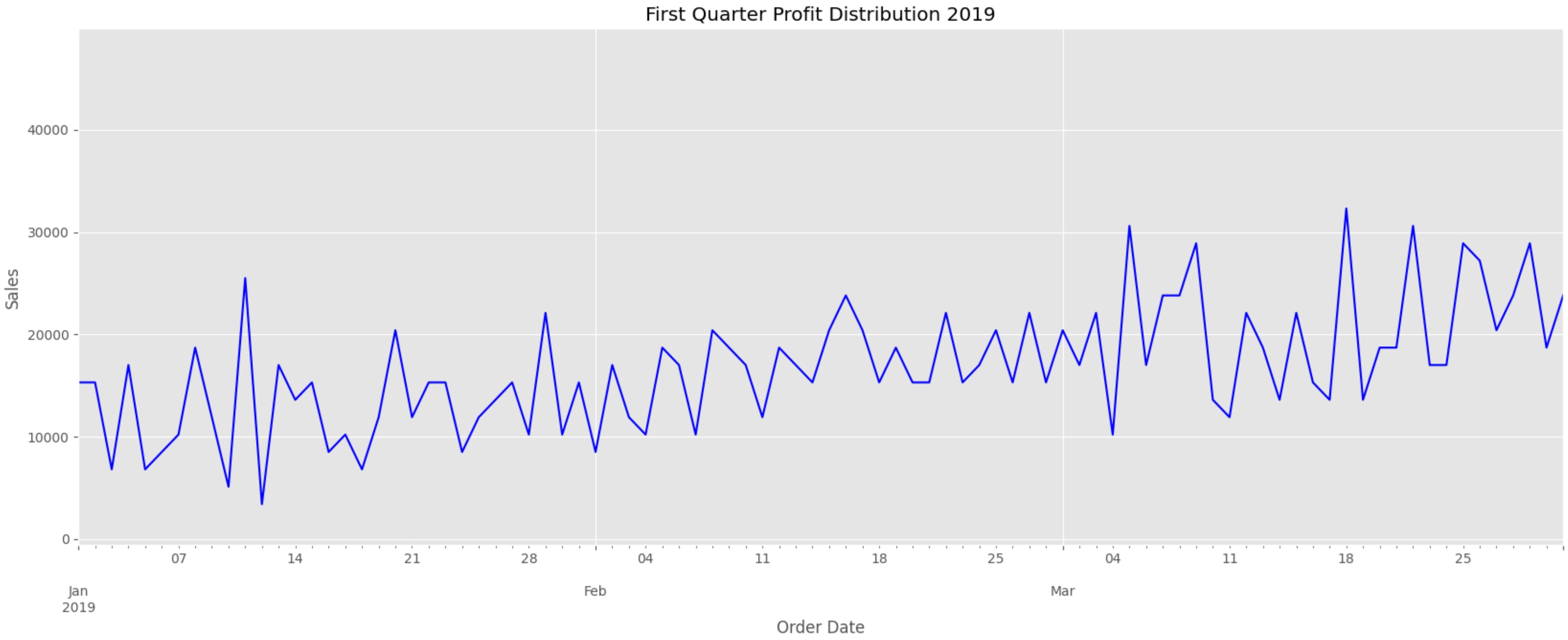
```
Order Date
2019-01-01    15300.0
2019-01-02    15300.0
2019-01-03     6800.0
2019-01-04    17000.0
2019-01-05     6800.0
2019-01-06     8500.0
2019-01-07    10200.0
2019-01-08    18700.0
2019-01-09    11900.0
2019-01-10     5100.0
Name: Sales, dtype: float64
```

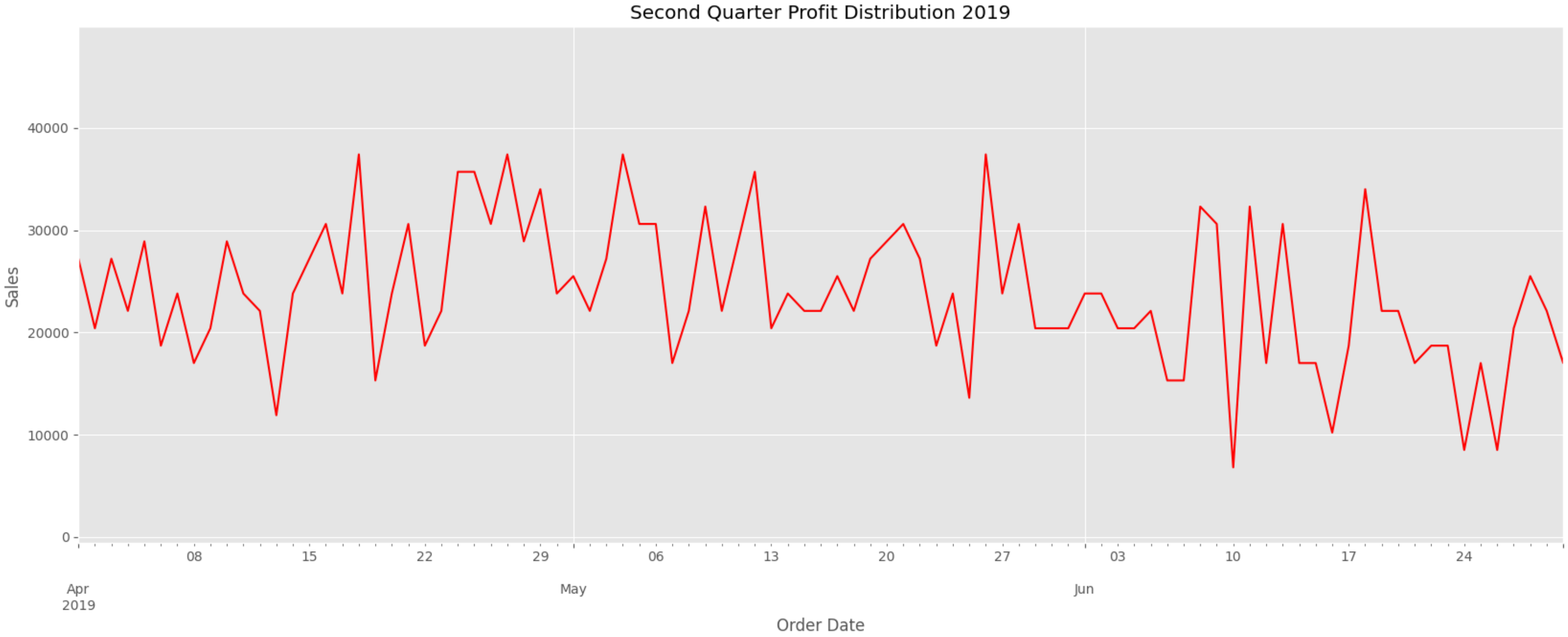
In [ ]:

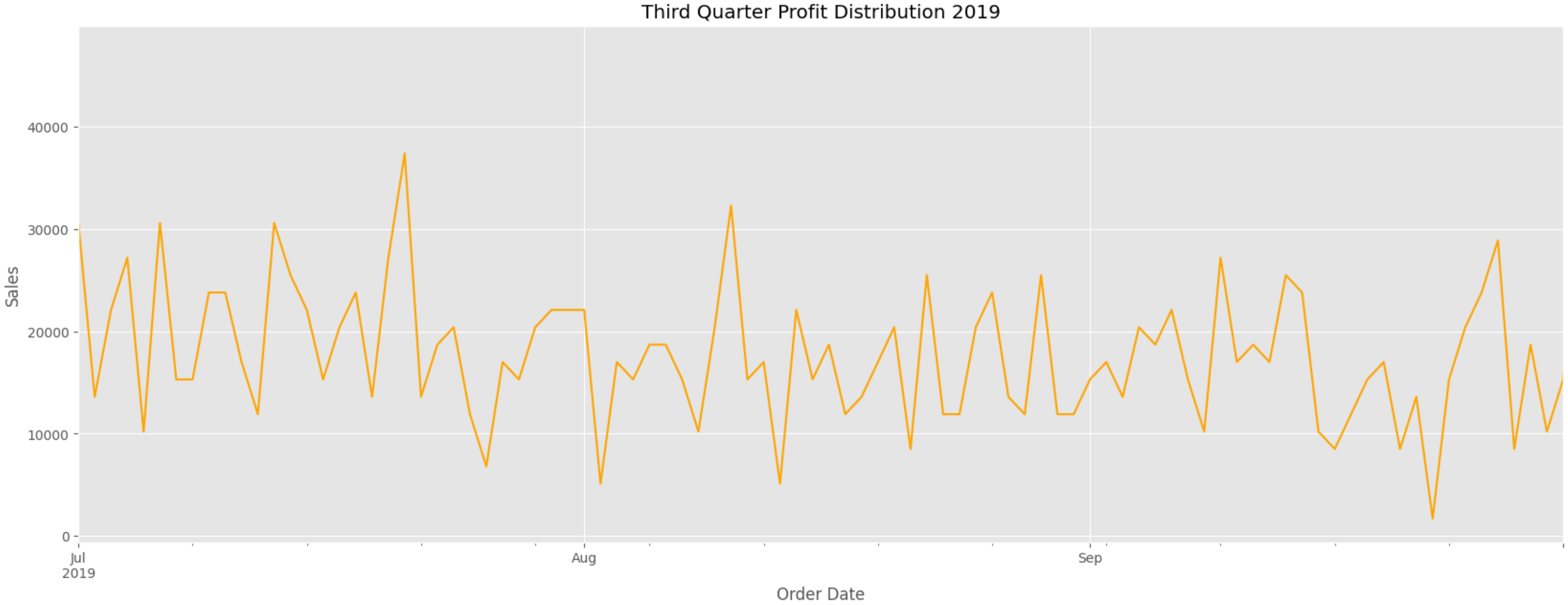
```
quarters = {'First Quarter Profit Distribution 2019':('2019-01-01','2019-03-31', 'blue'),
            'Second Quarter Profit Distribution 2019':('2019-04-01','2019-06-30', 'red'),
            'Third Quarter Profit Distribution 2019':('2019-07-01','2019-09-30', 'orange'),
            'Fourth Quarter Profit Distribution 2019':('2019-10-01','2019-12-31', 'purple')
            }
```

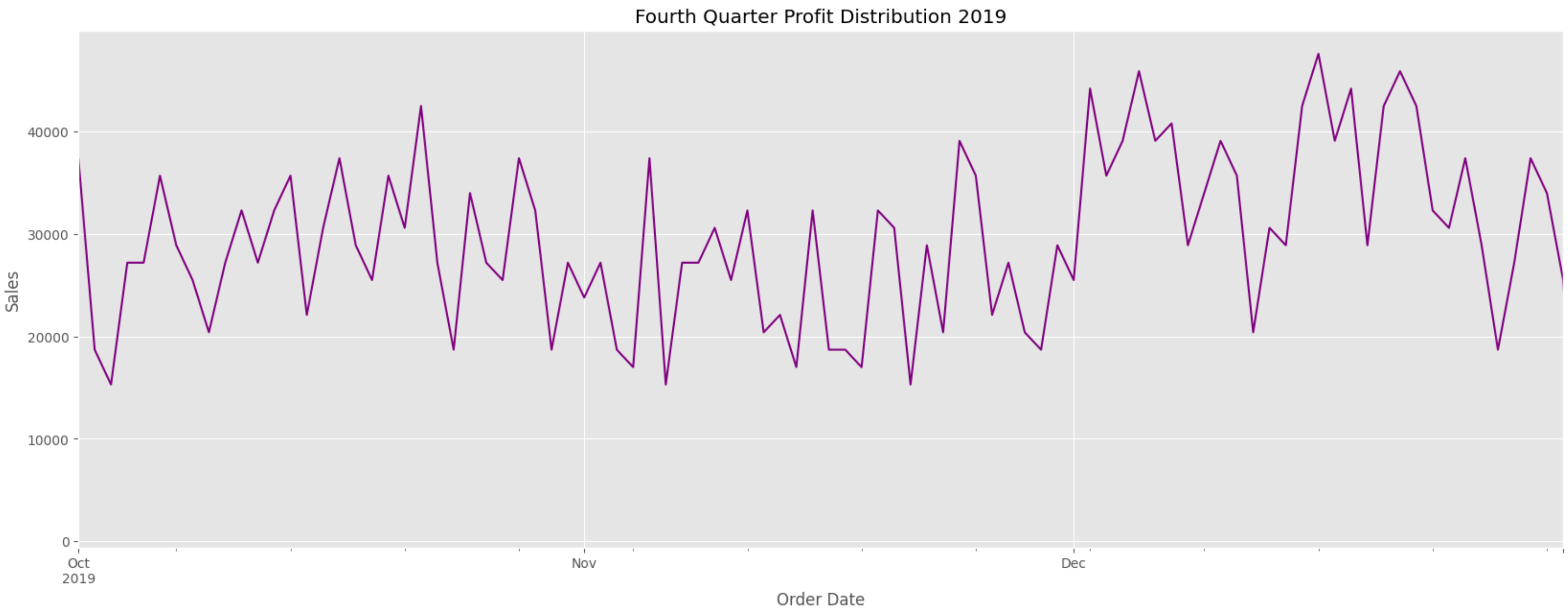
In [ ]:

```
for quarter, date in quarters.items():
    start, stop, color = date
    plt.figure(figsize=(20,7))
    mac2.plot(color=color)
    plt.xlim(start, stop)
    plt.title(quarter)
    plt.ylabel('Sales')
    plt.xlabel('Order Date')
    plt.show()
```




Second Quarter Profit Distribution 2019
Sales
0
10000
20000
30000
40000
08
15
22
29
06
13
20
27
03
10
17
24
Apr
2019
May
Jun
Order Date


Third Quarter Profit Distribution 2019
Sales
0
10000
20000
30000
40000
Jul
2019
Aug
Sep
Order Date



Total Sales Per Quarter

In [ ]:

```
total_sale_per_quarter = {"Quarters":['First Quarter','Second Quarter','Third Quarter','Fourth Quarter'],
                          "Average Sales":[np.ceil(mac2['2019-01-01':'2019-03-31'].sum()),np.ceil(mac2['2019-04-01':
                         }

total_sale_per_quarter = pd.DataFrame(total_sale_per_quarter)
total_sale_per_quarter
```

Out[ ]:

	Quarters	Average Sales
0	First Quarter	1511300.0
1	Second Quarter	2167500.0
2	Third Quarter	1623500.0
3	Fourth Quarter	2733600.0

Average Sales Quarterly

In [ ]:

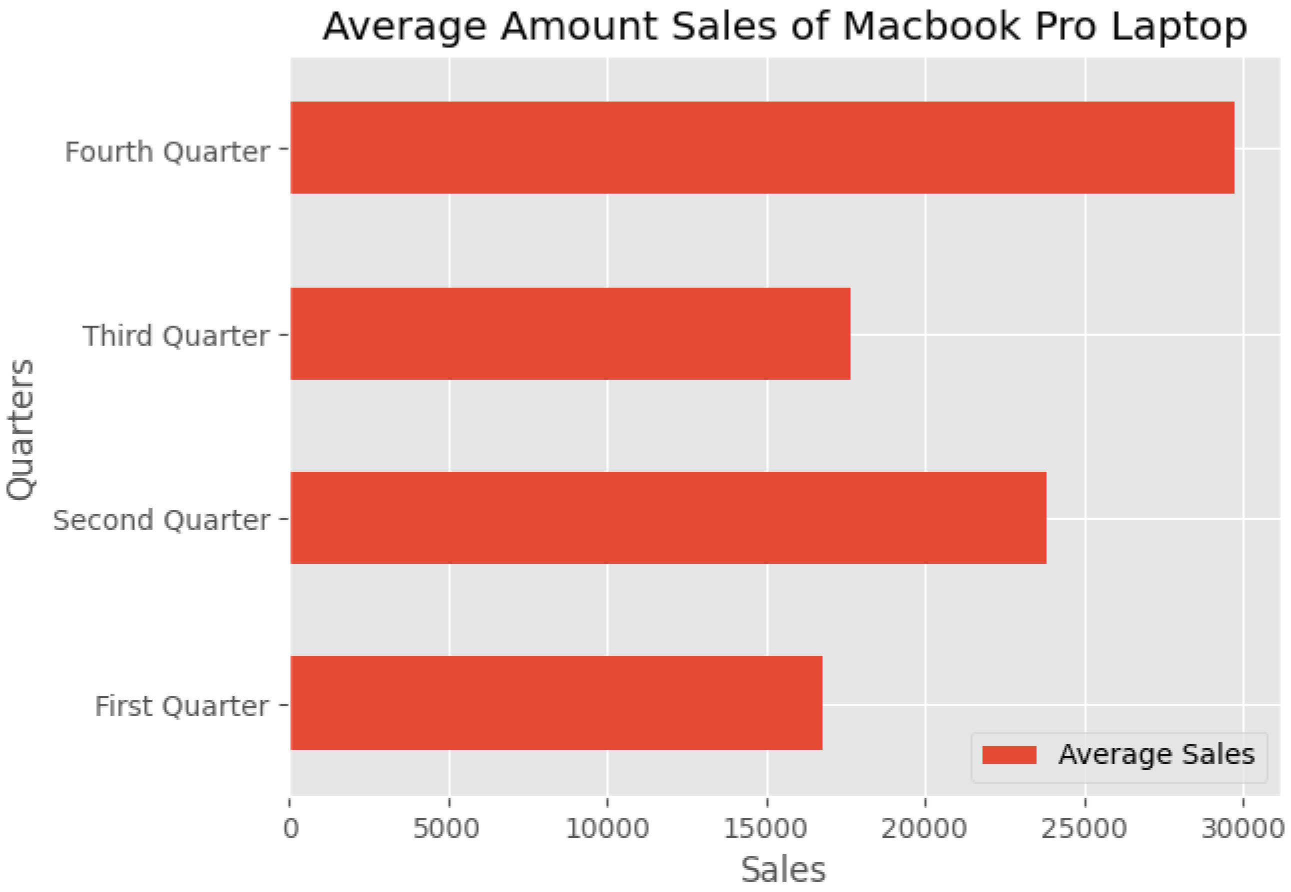
```
average_sale = {"Quarters":['First Quarter','Second Quarter','Third Quarter','Fourth Quarter'],
                "Average Sales":[np.ceil(mac2['2019-01-01':'2019-03-31'].mean()),np.ceil(mac2['2019-04-01':'2019-06-
                }

average_sale = pd.DataFrame(average_sale)
average_sale
```

Out[ ]:

	Quarters	Average Sales
0	First Quarter	16793.0
1	Second Quarter	23819.0
2	Third Quarter	17647.0
3	Fourth Quarter	29714.0

In [ ]:

```
average_sale.set_index('Quarters').plot(kind='barh')
plt.title("Average Amount Sales of Macbook Pro Laptop")
plt.xlabel("Sales")
plt.show()
```


Average Amount Sales of Macbook Pro Laptop
Quarters
Fourth Quarter
Third Quarter
Second Quarter
First Quarter
Average Sales
0
5000
10000
15000
20000
25000
30000
Sales