Product Sales Analysis

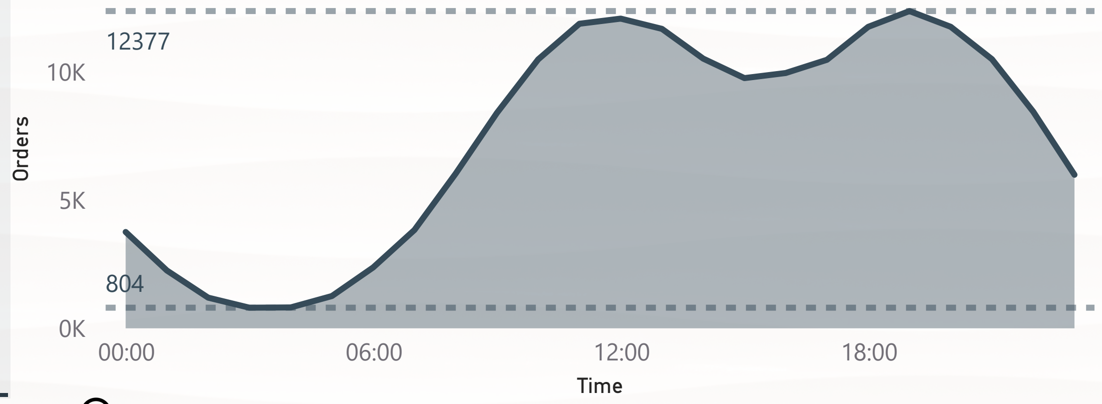
$34.47M	209K	178K
Revenue	Quantity	Orders

Insights

- What was the best Year for sales? How much was earned that Year? 2019, $34,456,867.65
- What was the best month for sales? How much was earned that month? December , $4,608,295.70
- What City had the highest number of sales? San Francisco
- What time should we display adverts to maximize likelihood of customer's buying product? 19:00:00
- What product sold the most? Why do you think it sold the most? AAA Batteries (4-pack),
- How much probability for next people will ordered USB-C Charging Cable? 12.25%
- How much probability for next people will ordered iPhone? 3.83%
- How much probability for next people will ordered Google Phone? 3.09%
- How much probability other peoples will ordered Wired Headphones? 10.56%

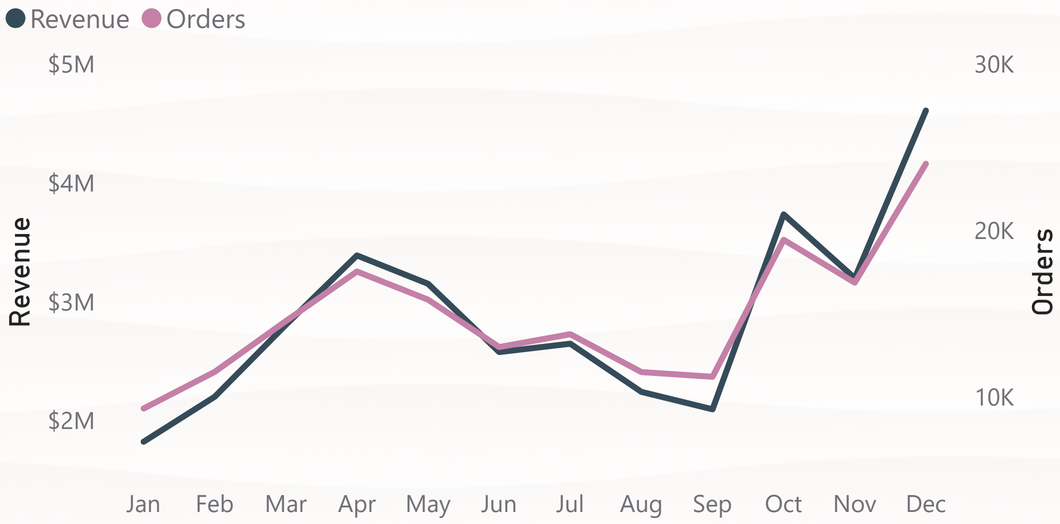
Orders by Time

All

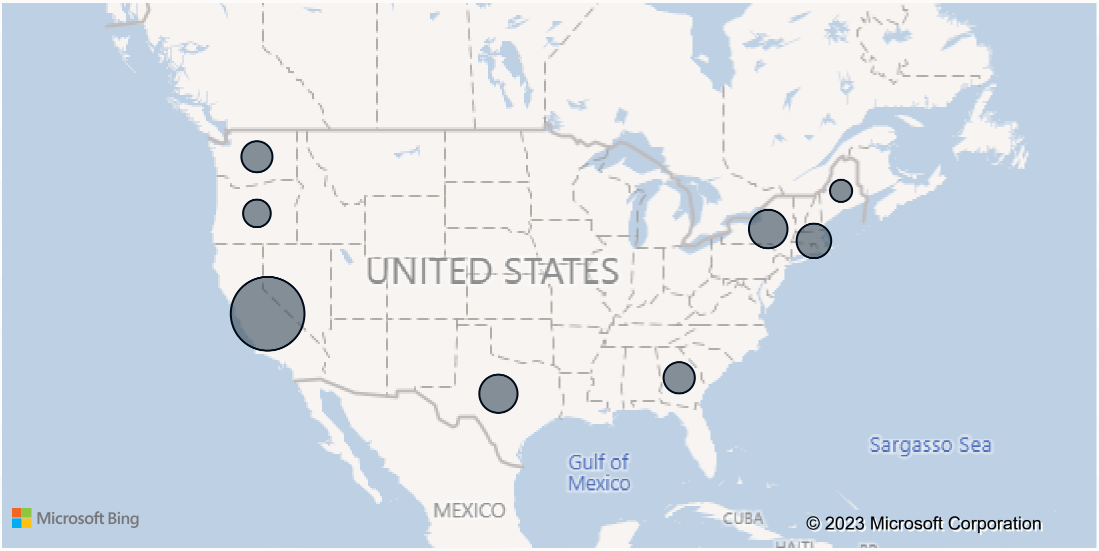


Macbook Pro Laptop	$8,032,500.00
iPhone	$4,792,900.00
ThinkPad Laptop	$4,127,958.72
Google Phone	$3,317,400.00
27in 4K Gaming Monitor	$2,433,147.61

Revenue & Orders by Month



Revenue by State

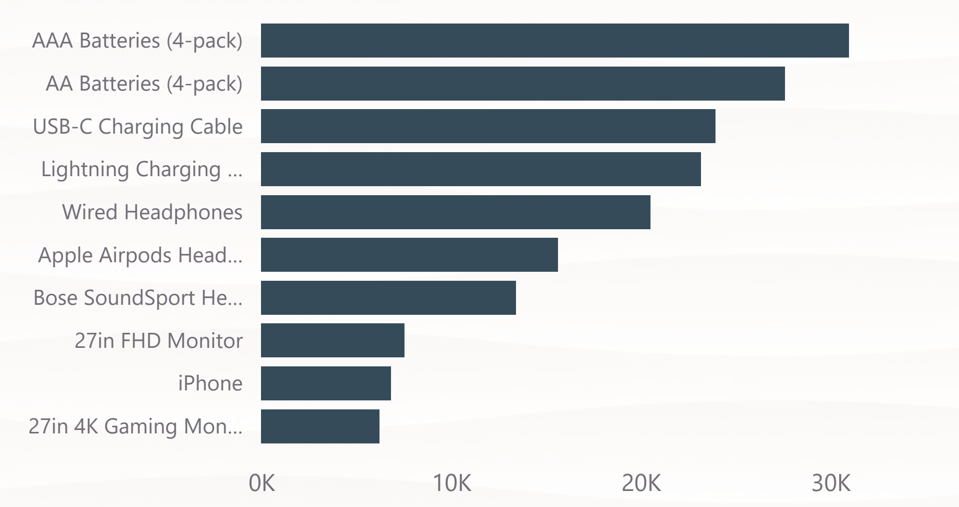


100.00%
Probability

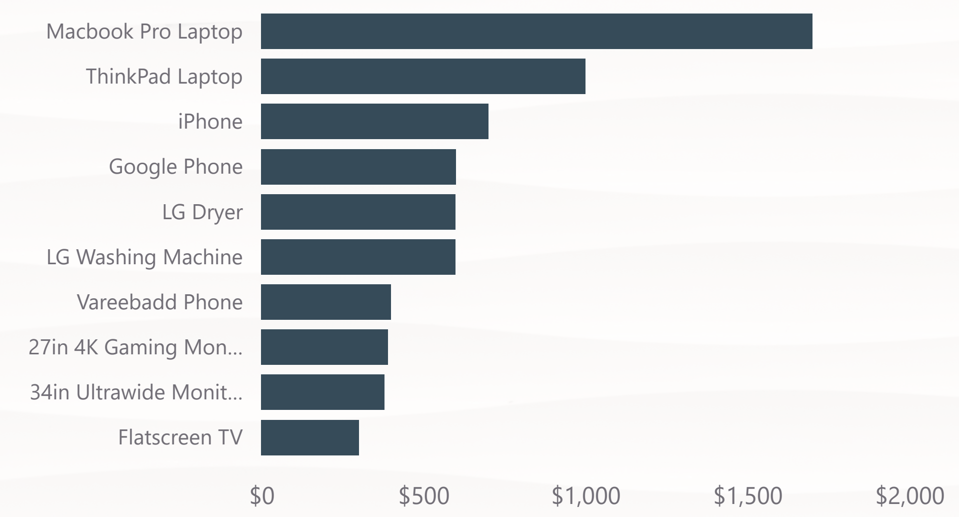
2019 2020

Product Analysis

Units Sold

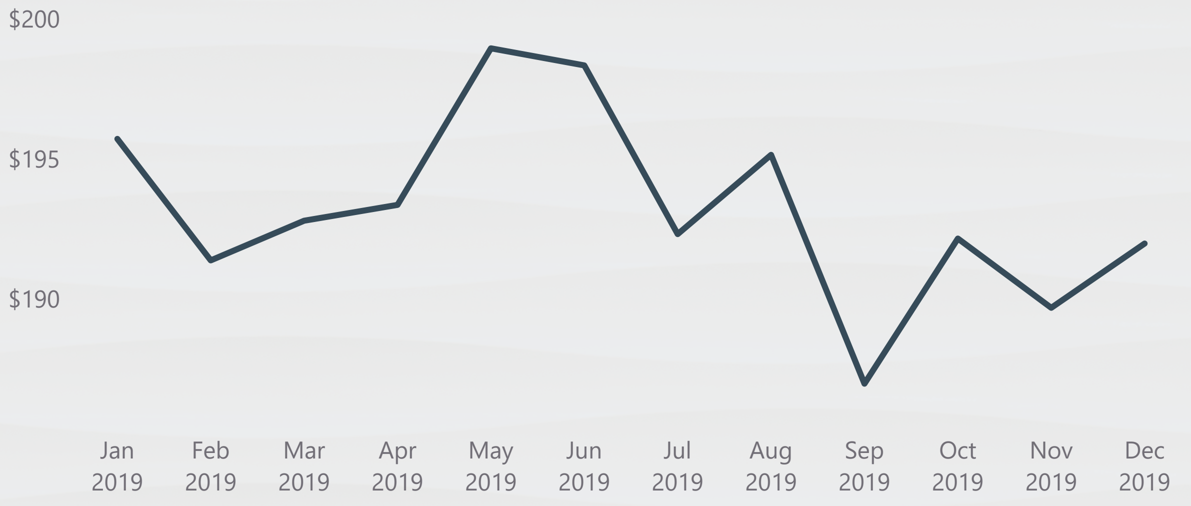


Average Revenue



Monthly Trends

Average Revenue



$34.47M

Revenue

$193.15

Avg Revenue

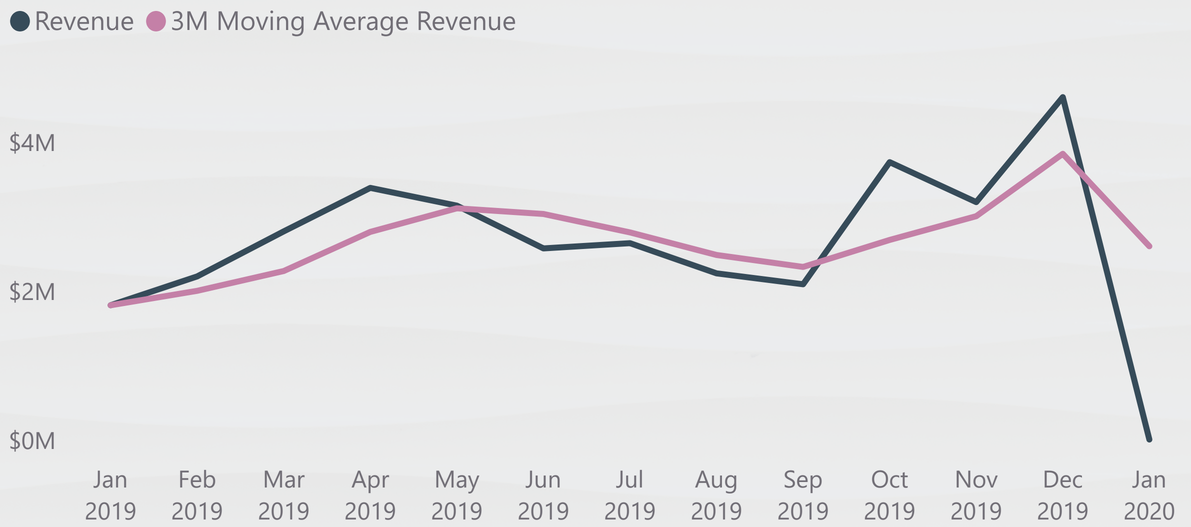
209K

Units Sold

178K

Orders

Revenue and 3M Moving Average Revenue

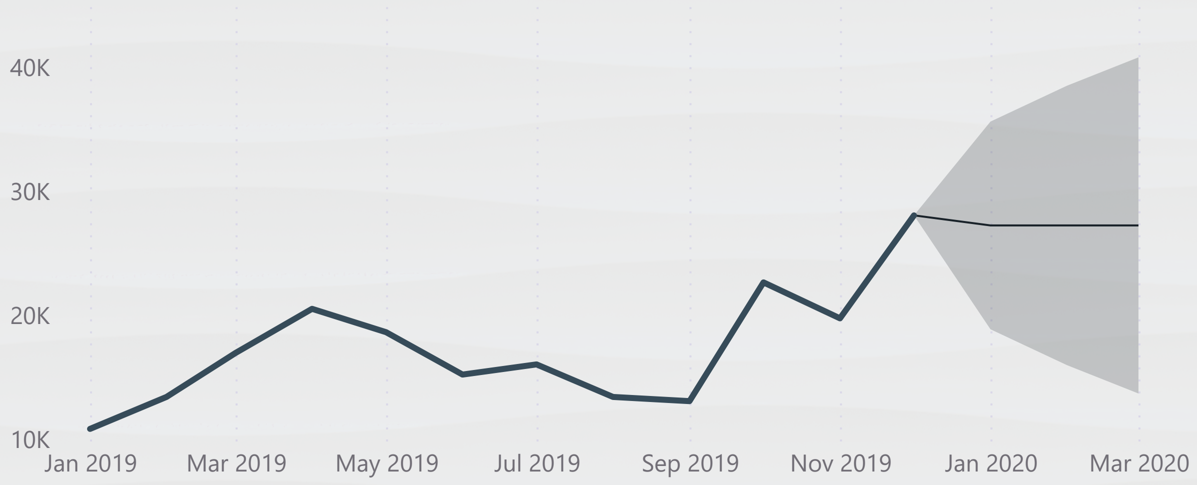


San Francisco	$8,254,743.55
Los Angeles	$5,448,304.28
New York City	$4,661,867.14
Boston	$3,658,627.65
Atlanta	$2,794,199.07

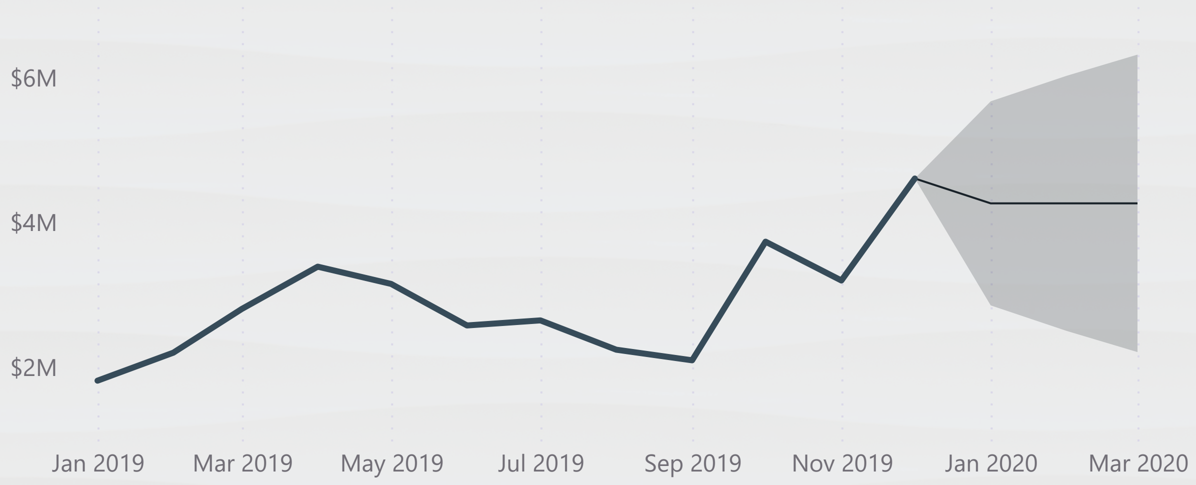
Monthly Forecast

$34.47M	209K	178K	CA
Revenue	Quantity	Orders	

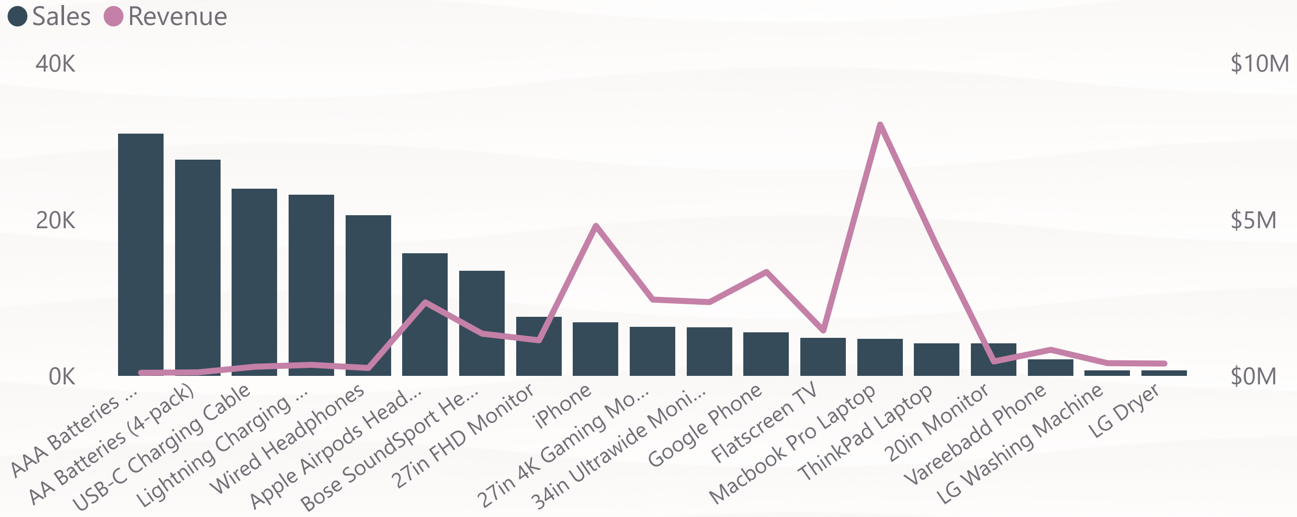
Sales



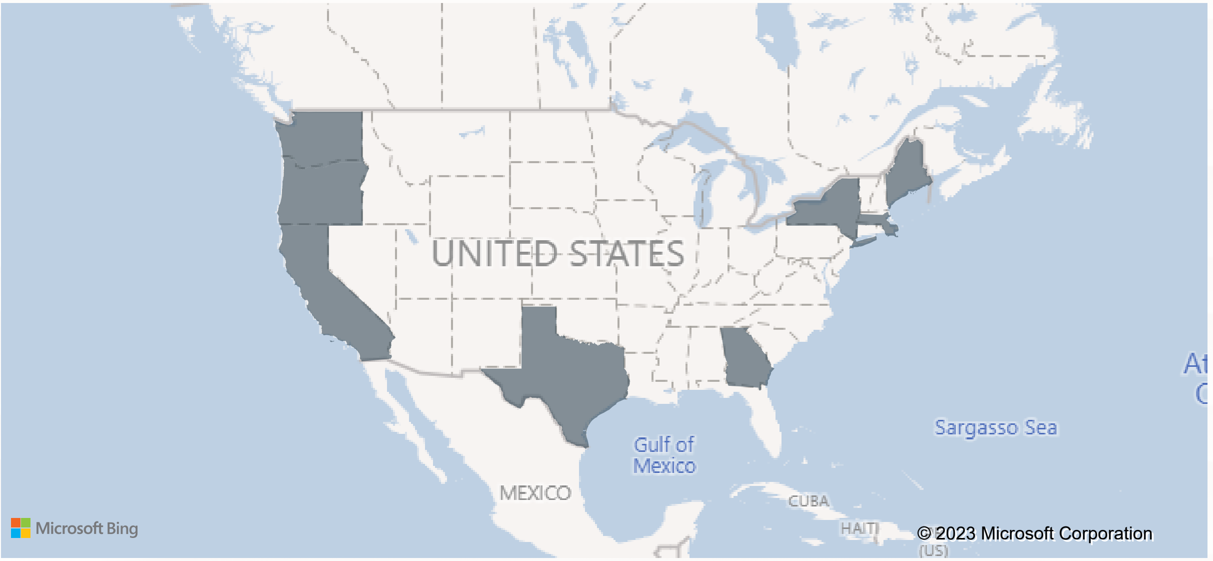
Revenue



Units Sold



State



In [ ]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sqlalchemy import create_engine
import datetime as dt
import plotly.express as px
import sys
import warnings
warnings.filterwarnings('ignore')
```

In [ ]:

```
# Using SQLAlchemy
table = 'vw_Sales'
engine_cloud = create_engine('mssql+pyodbc://localhost\SQLEXPRESS/Product_Database
df = pd.read_sql_table(table,engine_cloud.connect())
df
```

Out[ ]:

	Order_ID	Product	Quantity	Unit_Price	Revenue	Date	Time	Street Number	City
0	141234	iPhone	1	700.00	700.00	2019-01-22	21:25:00	944 Walnut St	Bostor
1	141235	Lightning Charging Cable	1	14.95	14.95	2019-01-28	14:15:00	185 Maple St	Portlanc
2	141236	Wired Headphones	2	11.99	23.98	2019-01-17	13:33:00	538 Adams St	Sar Franciscc
3	141237	27in FHD Monitor	1	149.99	149.99	2019-01-05	20:33:00	738 10th St	Los Angeles
4	141238	Wired Headphones	1	11.99	11.99	2019-01-25	11:59:00	387 10th St	Austir
...	...	...	...	...	...	...	...	...	..
185634	319666	Lightning Charging Cable	1	14.95	14.95	2019-12-11	20:58:00	14 Madison St	Sar Franciscc
185635	319667	AA Batteries (4-pack)	2	3.84	7.68	2019-12-01	12:01:00	549 Willow St	Los Angeles
185636	319668	Vareebadd Phone	1	400.00	400.00	2019-12-09	06:43:00	273 Wilson St	Seattle
185637	319669	Wired Headphones	1	11.99	11.99	2019-12-03	10:39:00	778 River St	Dallas
185638	319670	Bose SoundSport Headphones	1	99.99	99.99	2019-12-21	21:45:00	747 Chestnut St	Los Angeles

185639 rows × 11 columns

In [ ]:

```
df.isna().sum()
df[df.duplicated() == True]
```

Out[ ]:

Order_ID	Product	Quantity	Unit_Price	Revenue	Date	Time	Street Number	City	State	Zip Code

In [ ]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 185639 entries, 0 to 185638
Data columns (total 11 columns):
 #   Column         Non-Null Count   Dtype
---  ------         --------------   -----
 0   Order_ID       185639 non-null  int64
 1   Product        185639 non-null  object
 2   Quantity       185639 non-null  int64
 3   Unit_Price     185639 non-null  float64
 4   Revenue        185639 non-null  float64
 5   Date           185639 non-null  datetime64[ns]
 6   Time           185639 non-null  object
 7   Street Number  185639 non-null  object
 8   City           185639 non-null  object
 9   State          185639 non-null  object
 10  Zip Code       185639 non-null  object
dtypes: datetime64[ns](1), float64(2), int64(2), object(6)
memory usage: 15.6+ MB
```

In [ ]:

```
df.describe()
```

Out[ ]:

	Order_ID	Quantity	Unit_Price	Revenue
count	185639.000000	185639.000000	185639.000000	185639.000000
mean	230409.453342	1.124387	184.564465	185.656438
std	51511.882910	0.442729	332.873834	333.062502
min	141234.000000	1.000000	2.990000	2.990000
25%	185828.500000	1.000000	11.950000	11.950000
50%	230354.000000	1.000000	14.950000	14.950000
75%	275026.500000	1.000000	150.000000	150.000000
max	319670.000000	9.000000	1700.000000	3400.000000

In [ ]:

```
# df['Time'] = pd.to_timedelta(df['Time'],unit='hours')
df['Time'] = df['Time'].apply(lambda x: dt.time(int(x.split(':')[0]),int(x.split('
```

In [ ]:

```
df['Month'] = df['Date'].apply(lambda x: x.month)
df['Year'] = df['Date'].apply(lambda x: x.year)
```

In [ ]:

```
Revenue_by_year = df.groupby(df['Year'])['Revenue'].sum()
Revenue_by_year
```

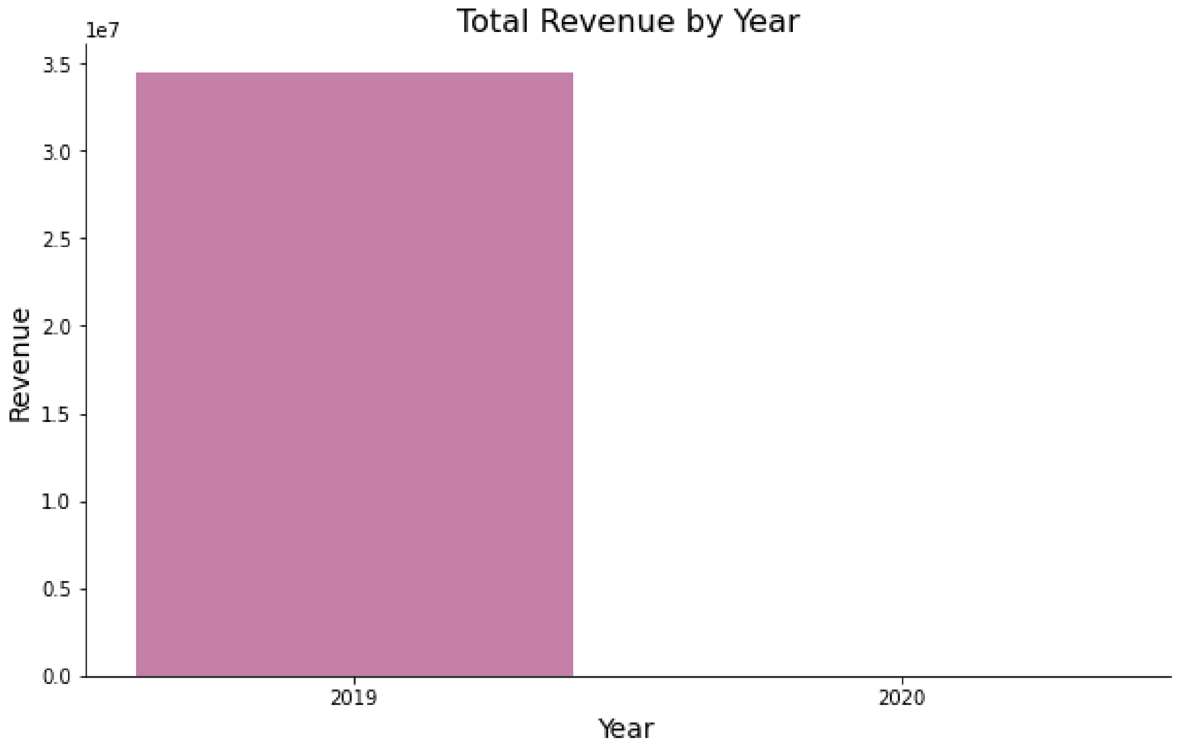
Out[ ]:

```
Year
2019    34456405.16
2020        8670.29
Name: Revenue, dtype: float64
```

In [ ]:

```
fig, ax = plt.subplots(figsize=(10,6))
ax.bar(Revenue_by_year.index, Revenue_by_year.values, color='#C480A7')
```

```
# sns.countplot(x='Revenue',data=Revenue_by_year)
plt.title('Total Revenue by Year', fontsize=16)
plt.xlabel('Year', fontsize=14)
plt.ylabel('Revenue', fontsize=14)
plt.xticks(ticks=[2019,2020],labels=('2019','2020'), ha='center')
sns.despine(left=False, bottom=False)
plt.show()
```



In [ ]:

```
Monthly_Sales = df.groupby(df['Month'])[['Quantity','Revenue']].sum().reset_index(
month = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sept', 'Oct', 'N
Monthly_Sales
```

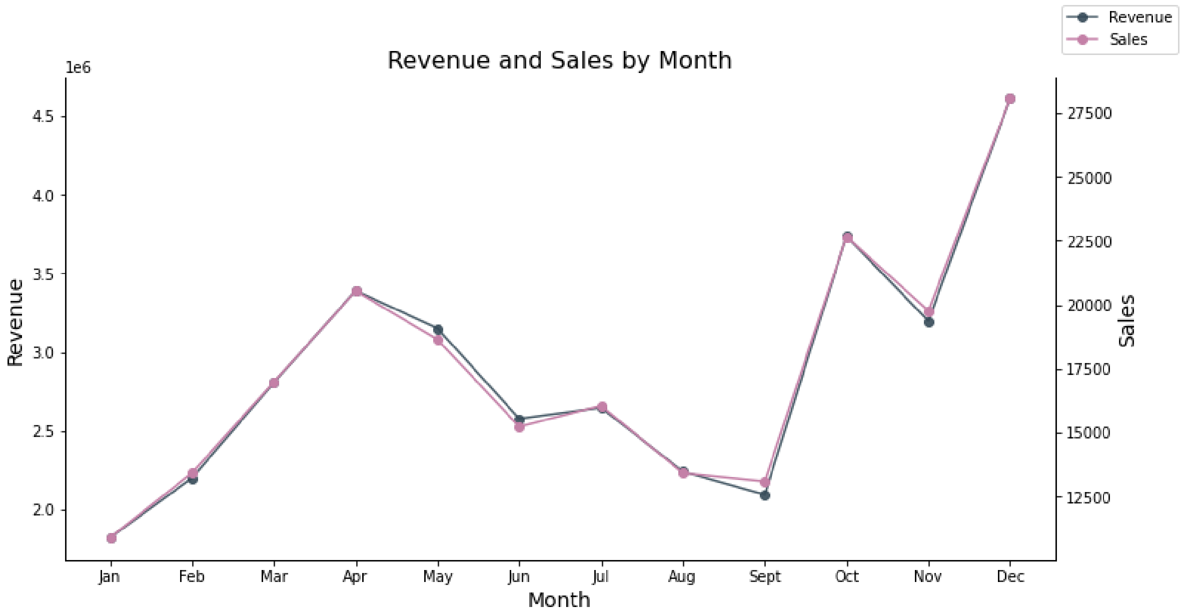
Out[ ]:

	Month	Quantity	Revenue
0	1	10893	1821413.16
1	2	13425	2200012.30
2	3	16976	2804954.57
3	4	20532	3389203.47
4	5	18641	3150537.62
5	6	15232	2576265.21
6	7	16051	2646434.43
7	8	13418	2241042.83
8	9	13090	2094453.70
9	10	22661	3734714.66
10	11	19760	3197823.37
11	12	28051	4608220.13

In [ ]:

```
fig, ax = plt.subplots(figsize=(12,6))
ax.plot(month, Monthly_Sales.Revenue,'o-', color='#364B59',alpha=0.9, label='Reven
ax2 = ax.twinx()
ax2.plot(month, Monthly_Sales.Quantity,'o-',color='#C480A7', label='Sales')
```

```
ax.set_title('Revenue and Sales by Month', fontsize=16)
ax.set_xlabel('Month', fontsize=14)
ax.set_ylabel('Revenue', fontsize=14)
ax2.set_ylabel('Sales', fontsize=14)
ax.set_xticks(ticks=range(12),labels=month, ha='center')
sns.despine(left=False, right=False, bottom=False)
fig.legend()
plt.show()
```

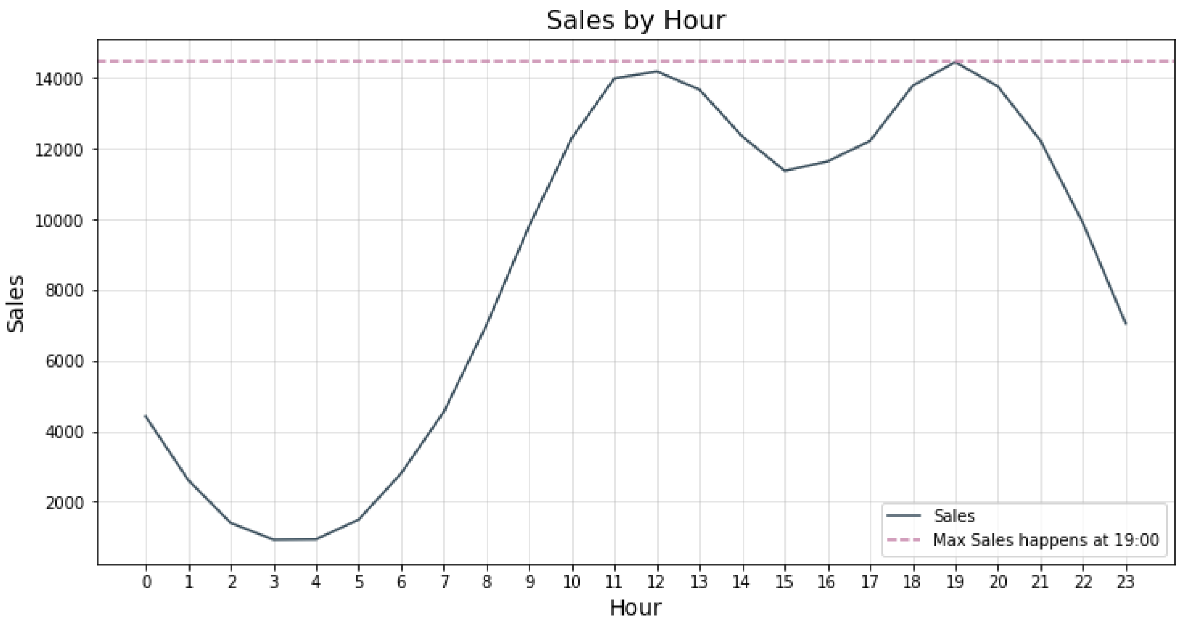


In [ ]:

```
df['Hour'] = df['Time'].apply(lambda x: x.hour)
Sales_by_Hour = df.groupby(['Hour'])['Quantity'].sum()
```

In [ ]:

```
fig, ax = plt.subplots(figsize=(12,6))
ax.plot(Sales_by_Hour.index, Sales_by_Hour.values, ls='-',c='#364B59', label='Sale
ax.set_title('Sales by Hour', fontsize=16)
ax.set_xlabel('Hour', fontsize=14)
ax.set_xticks(range(24), fontsize=14)
ax.set_ylabel('Sales', fontsize=14)
ax.grid('both', alpha=0.4)
ax.axhline(y=max(Sales_by_Hour.values), ls= '--', color='#C480A7', label=f'Max Sal
plt.legend()
plt.show()
```

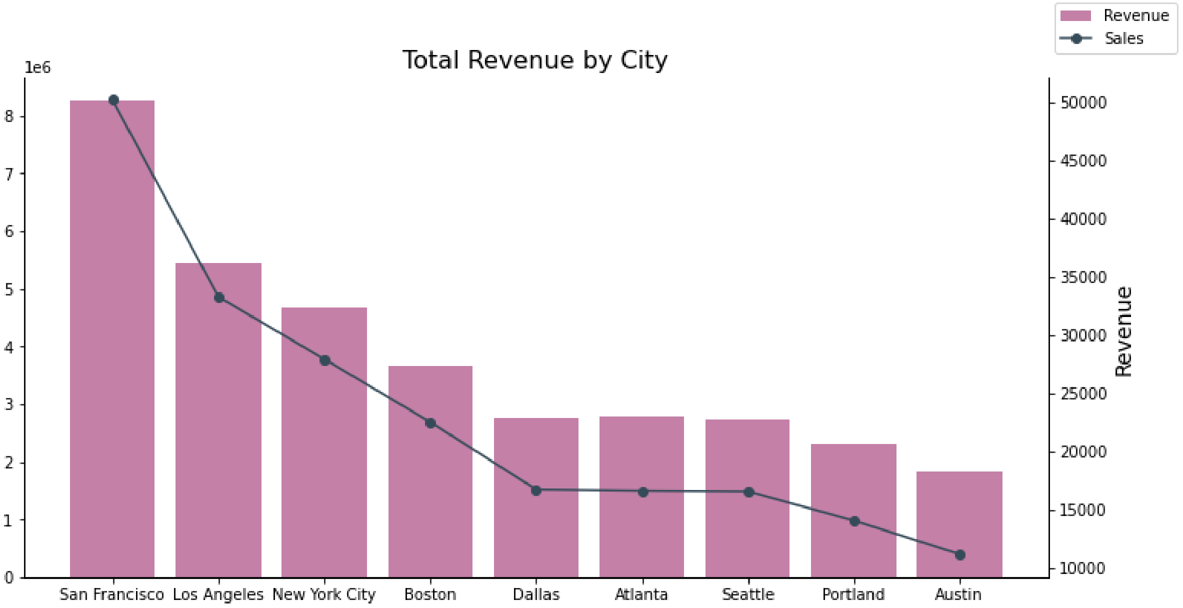


In [ ]:

```
Sales_by_City = df.groupby(df['City'])[['Quantity','Revenue']].sum().reset_index()
```

In [ ]:

```
fig, ax = plt.subplots(figsize=(12,6))
ax.bar(Sales_by_City.City, Sales_by_City.Revenue, color='#C480A7',label='Revenue')
ax2 = ax.twinx()
ax2.plot(Sales_by_City.City, Sales_by_City.Quantity, 'o-',c='#364B59', label='Sale
plt.title('Total Revenue by City', fontsize=16)
plt.xlabel('City', fontsize=14)
plt.ylabel('Revenue', fontsize=14)
# plt.xticks(Sales_by_City.City, ha='center')
sns.despine(left=False, right=False, bottom=False)
fig.legend()
plt.show()
```



In [ ]:

```
Sales_by_State = df.groupby(df['State'])[['Quantity','Revenue']].sum().reset_index
Sales_by_State
```

Out[ ]:

	State	Quantity	Revenue
0	ME	2745	449309.39
1	OR	11285	1869967.85
2	WA	16526	2745020.40
3	GA	16582	2794180.28
4	MA	22486	3658576.41
5	TX	27831	4583326.03
6	NY	27889	4661785.60
7	CA	83386	13702909.49

In [ ]:

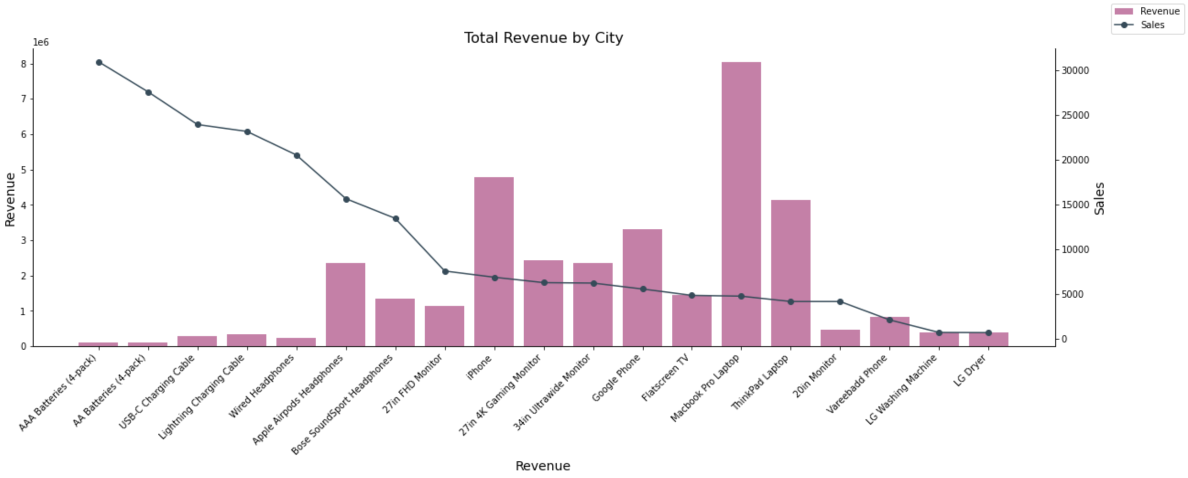
```
fig = px.choropleth(Sales_by_State, locations='State', locationmode="USA-states", 
fig.show()
```

In [ ]:

```
Sales_by_Products = df.groupby(df['Product'])[['Quantity','Revenue']].sum().reset_
```

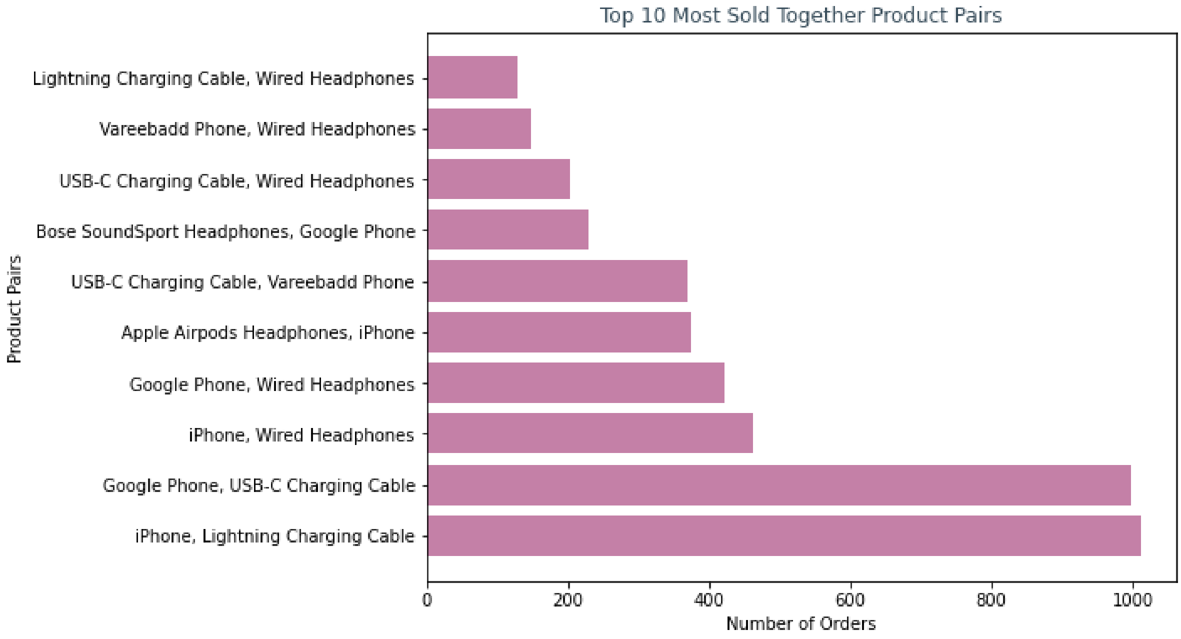
In [ ]:

```
fig, ax = plt.subplots(figsize=(20,6))
ax.bar(Sales_by_Products.Product, Sales_by_Products.Revenue, color='#C480A7',label
ax2 = ax.twinx()
ax2.plot( Sales_by_Products.Product, Sales_by_Products.Quantity, 'o-',c='#364B59',
ax.set_title('Total Revenue by City', fontsize=16)
ax.set_xlabel('Revenue', fontsize=14)
ax.set_xticklabels(Sales_by_Products.Product, rotation=45, ha='right')
ax.set_ylabel('Revenue', fontsize=14)
ax2.set_ylabel('Sales', fontsize=14)
sns.despine(left=False, right=False, bottom=False)
fig.legend()
plt.show()
```



In [ ]:

```
from itertools import combinations
from collections import Counter

# drop it using duplicated() funct
data = df[df['Order_ID'].duplicated(keep=False)]

# create a new column
data['Grouped'] = df.groupby('Order_ID')['Product'].transform(lambda x: ','.join(x

# Create a new DataFrame with unique Order IDs and grouped products
data = data[['Order_ID', 'Grouped']].drop_duplicates()

# create a new variable for Counter
count = Counter()

# make a for loop
for row in data['Grouped']:
    row_list = row.split(',')
    count.update(Counter(combinations(row_list, 2)))

# # and make another for loop
# for key, value in count.most_common(10):
#     print(key, value)

# Create a bar chart of the top 10 most commonly sold together products
top_items = count.most_common(10)
item_pairs = [', '.join(pair) for pair, count in top_items]
item_counts = [count for pair, count in top_items]

fig, ax = plt.subplots(figsize=(8, 6))
ax.barh(item_pairs, item_counts, color='#C480A7')
ax.set_xlabel('Number of Orders')
ax.set_ylabel('Product Pairs')
ax.set_title('Top 10 Most Sold Together Product Pairs', color='#364B59')

plt.show()
```



In [ ]:

```
def probability(product):
    try:
        if product in df['Product'].unique():
            total = len(df['Order_ID'].unique())
            frequency = df['Order_ID'][df['Product']== product].value_counts().sum
            print(f"Probability of ordering {product}: %{frequency*100/total:.2f}"
        else:
            raise Exception
    except Exception:
        raise Exception('Enter a Valid Product')
        # sys.exit("Enter a Valid Product")
```

In [ ]:

```
probability('USB-C Charging Cable')
probability('iPhone')
probability('Google Phone')
probability('Wired Headphones')
```

```
Probability of ordering USB-C Charging Cable: %12.25
Probability of ordering iPhone: %3.83
Probability of ordering Google Phone: %3.09
Probability of ordering Wired Headphones: %10.56
```