salesanalysis

June 23, 2024

1 Sales Analysis

Importing libraries

[1]:
```
import pandas as pd
import os
from datetime import datetime as dt
import matplotlib.pyplot as plt
```

Merging 12 months sales data

[2]:
```
files = [i for i in os.listdir('//Mac/Home/Downloads/
 ↪Pandas-Data-Science-Tasks-master/SalesAnalysis/Sales_Data/')]

df = pd.DataFrame()

for file in files:
    df1 = pd.read_csv('//Mac/Home/Downloads/Pandas-Data-Science-Tasks-master/
 ↪SalesAnalysis/Sales_Data/'+file)
    df = pd.concat([df,df1])

df.head()
```

[2]:

	Order ID	Product	Quantity Ordered	Price Each	Order Date	\
0	295665	Macbook Pro Laptop	1	1700	12/30/19 00:01	
1	295666	LG Washing Machine	1	600.0	12/29/19 07:03	
2	295667	USB-C Charging Cable	1	11.95	12/12/19 18:21	
3	295668	27in FHD Monitor	1	149.99	12/22/19 15:13	
4	295669	USB-C Charging Cable	1	11.95	12/18/19 12:38	

	Purchase Address
0	136 Church St, New York City, NY 10001
1	562 2nd St, New York City, NY 10001
2	277 Main St, New York City, NY 10001
3	410 6th St, San Francisco, CA 94016
4	43 Hill St, Atlanta, GA 30301

Data Cleaning

[3]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 186850 entries, 0 to 13621
Data columns (total 6 columns):
 #   Column            Non-Null Count   Dtype 
---  ------            --------------   ----- 
 0   Order ID          186305 non-null  object
 1   Product           186305 non-null  object
 2   Quantity Ordered  186305 non-null  object
 3   Price Each        186305 non-null  object
 4   Order Date        186305 non-null  object
 5   Purchase Address  186305 non-null  object
dtypes: object(6)
memory usage: 10.0+ MB
```

[4]:
```
df.isna().sum()
```

[4]:
```
Order ID            545
Product             545
Quantity Ordered    545
Price Each          545
Order Date          545
Purchase Address    545
dtype: int64
```

[5]:
```
df.dropna(how='all',inplace=True)
```

[6]:
```
df.isna().sum()
```

[6]:
```
Order ID            0
Product             0
Quantity Ordered    0
Price Each          0
Order Date          0
Purchase Address    0
dtype: int64
```

[7]:
```
df.value_counts()
```

[7]:
```
Order ID  Product                  Quantity Ordered  Price Each  Order Date
Purchase Address
Order ID  Product                  Quantity Ordered  Price Each  Order Date
Purchase Address                       355
158236    AA Batteries (4-pack)    1                 3.84        02/19/19 09:49
319 West St, San Francisco, CA 94016     2
315204    Wired Headphones         1                 11.99       12/12/19 12:41
```

```
680 6th St, San Francisco, CA 94016       2
256196    USB-C Charging Cable      1                11.95       09/27/19 21:09
253 6th St, Boston, MA 02215              2
256763    27in FHD Monitor          1                149.99      09/15/19 22:28
23 11th St, San Francisco, CA 94016       2
                                          …
200687    Lightning Charging Cable  1                14.95       05/11/19 11:31
878 7th St, Atlanta, GA 30301             1
200688    27in 4K Gaming Monitor    1                389.99      05/22/19 10:31
731 Wilson St, Los Angeles, CA 90001      1
200689    USB-C Charging Cable      1                11.95       05/30/19 13:24
804 13th St, Portland, ME 04101           1
200690    27in FHD Monitor          1                149.99      05/20/19 19:31
781 Maple St, Los Angeles, CA 90001       1
230355    AA Batteries (4-pack)     2                3.84        07/03/19 16:37
849 Maple St, Boston, MA 02215            1
Length: 185687, dtype: int64
```

[8]:
```
df[df['Order ID']=='Order ID']
```

[8]:
```
       Order ID  Product  Quantity Ordered  Price Each  Order Date  \
254    Order ID  Product  Quantity Ordered  Price Each  Order Date
705    Order ID  Product  Quantity Ordered  Price Each  Order Date
1101   Order ID  Product  Quantity Ordered  Price Each  Order Date
2875   Order ID  Product  Quantity Ordered  Price Each  Order Date
3708   Order ID  Product  Quantity Ordered  Price Each  Order Date
…         …      …                …          …          …
10443  Order ID  Product  Quantity Ordered  Price Each  Order Date
10784  Order ID  Product  Quantity Ordered  Price Each  Order Date
10813  Order ID  Product  Quantity Ordered  Price Each  Order Date
11047  Order ID  Product  Quantity Ordered  Price Each  Order Date
13304  Order ID  Product  Quantity Ordered  Price Each  Order Date

       Purchase Address
254    Purchase Address
705    Purchase Address
1101   Purchase Address
2875   Purchase Address
3708   Purchase Address
…                 …
10443  Purchase Address
10784  Purchase Address
10813  Purchase Address
11047  Purchase Address
13304  Purchase Address

[355 rows x 6 columns]
```

[9]:
```
df = df[~(df['Order ID']=='Order ID')]
```

[10]:
```
df.duplicated().sum()
```

[10]:
```
264
```

[11]:
```
df.drop_duplicates(inplace=True)
```

[12]:
```
df['Quantity Ordered'] = df['Quantity Ordered'].astype('int')
df['Price Each'] = df['Price Each'].astype('float')
df['Order Date'] = df['Order Date'].astype('datetime64')
```

[13]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 185686 entries, 0 to 13621
Data columns (total 6 columns):
 #   Column            Non-Null Count   Dtype
---  ------            --------------   -----
 0   Order ID          185686 non-null  object
 1   Product           185686 non-null  object
 2   Quantity Ordered  185686 non-null  int32
 3   Price Each        185686 non-null  float64
 4   Order Date        185686 non-null  datetime64[ns]
 5   Purchase Address  185686 non-null  object
dtypes: datetime64[ns](1), float64(1), int32(1), object(3)
memory usage: 9.2+ MB
```

What was the best month for sales? How much was earned that month?

[14]:
```
df['month'] = df['Order Date'].dt.strftime('%B')
df['sales'] = df['Quantity Ordered']*df['Price Each']
```

[15]:
```
df.head()
```

[15]:

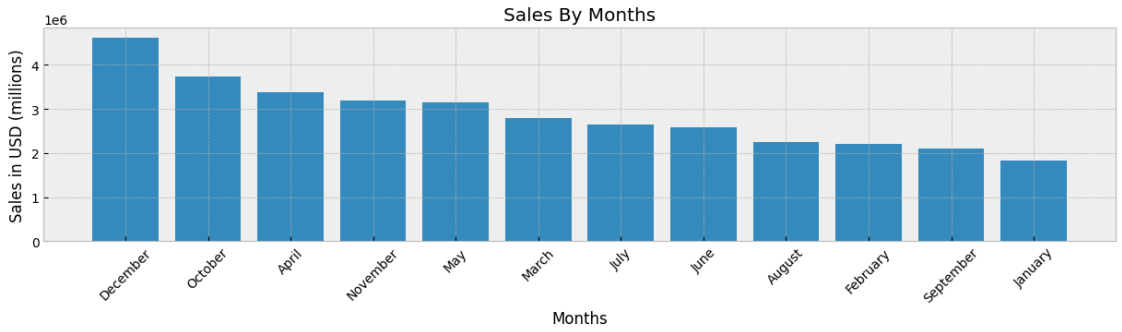
	Order ID	Product	Quantity Ordered	Price Each	Order Date	Purchase Address	month	sales
0	295665	Macbook Pro Laptop	1	1700.00	2019-12-30 00:01:00	136 Church St, New York City, NY 10001	December	1700.00
1	295666	LG Washing Machine	1	600.00	2019-12-29 07:03:00	562 2nd St, New York City, NY 10001	December	600.00
2	295667	USB-C Charging Cable	1	11.95	2019-12-12 18:21:00	277 Main St, New York City, NY 10001	December	11.95
3	295668	27in FHD Monitor	1	149.99	2019-12-22 15:13:00	410 6th St, San Francisco, CA 94016	December	149.99
4	295669	USB-C Charging Cable	1	11.95	2019-12-18 12:38:00	43 Hill St, Atlanta, GA 30301	December	11.95

```
     sales
0  1700.00
1   600.00
2    11.95
3   149.99
4    11.95
```

[16]:
```
(df.groupby('month').agg({'sales':'sum'}).sort_values('sales',ascending=False).
 ↪reset_index()).iloc[0]
```

[16]:
```
month     December
sales    4608295.7
Name: 0, dtype: object
```

[17]:
```
SalesSumByMonth = df.groupby('month').agg({'sales':'sum'}).
 ↪sort_values('sales',ascending=False).reset_index()
monthname = SalesSumByMonth['month']
Sales = SalesSumByMonth['sales']

plt.style.use('bmh')
plt.figure(figsize=(15,3))
plt.title('Sales By Months')
plt.xlabel('Months')
plt.ylabel('Sales in USD (millions)')
plt.xticks(rotation=45)

plt.bar(monthname,Sales)

plt.show()
```



Which City had the highest Sales?

[18]:
```
#df['city'] = df['Purchase Address'].str.split(',').str[1].str.strip() or
df['city'] = df['Purchase Address'].apply(lambda x : x.split(',')[1].strip())
```

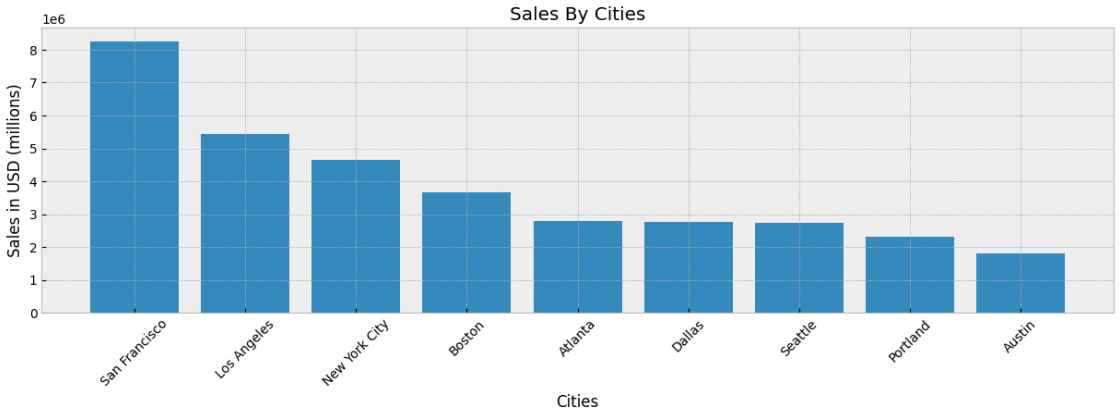
[19]:
```
df.head()
```

[19]:
```
   Order ID               Product  Quantity Ordered  Price Each  \
0    295665    Macbook Pro Laptop                 1     1700.00
1    295666    LG Washing Machine                 1      600.00
2    295667  USB-C Charging Cable                 1       11.95
3    295668      27in FHD Monitor                 1      149.99
4    295669  USB-C Charging Cable                 1       11.95

            Order Date                        Purchase Address     month  \
0  2019-12-30 00:01:00  136 Church St, New York City, NY 10001  December
1  2019-12-29 07:03:00     562 2nd St, New York City, NY 10001  December
2  2019-12-12 18:21:00    277 Main St, New York City, NY 10001  December
3  2019-12-22 15:13:00     410 6th St, San Francisco, CA 94016  December
4  2019-12-18 12:38:00           43 Hill St, Atlanta, GA 30301  December

     sales           city
0  1700.00  New York City
1   600.00  New York City
2    11.95  New York City
3   149.99  San Francisco
4    11.95        Atlanta
```

[20]:
```
df.groupby('city').agg({'sales':'sum'}).sort_values('sales',ascending=False).
 ↪reset_index().iloc[0]
```

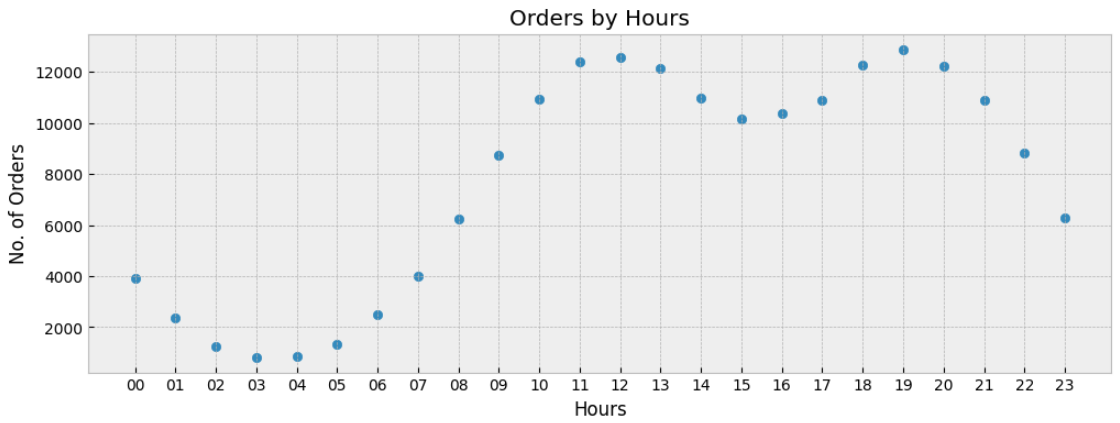
[20]:
```
city     San Francisco
sales       8254743.55
Name: 0, dtype: object
```

[21]:
```
SalesSumByCity = df.groupby('city').agg({'sales':'sum'}).
 ↪sort_values('sales',ascending=False).reset_index()
City = SalesSumByCity['city']
Sales = SalesSumByCity['sales']

plt.figure(figsize=(15,4))
plt.title('Sales By Cities')
plt.xticks(rotation=45)
plt.xlabel('Cities')
plt.ylabel('Sales in USD (millions)')
plt.bar(City,Sales)
plt.show()
```



What time should we display advertisements to maximize likelihood of customer's buying product?

[22]:
```
SalesByHour = df.groupby(df['Order Date'].dt.strftime('%H')).agg({'Order ID':
 ↪'count'}).reset_index()
SalesByHour.rename(columns={'Order Date':'Hour'},inplace=True)
hour = SalesByHour['Hour']
OrderCount = SalesByHour['Order ID']

plt.figure(figsize=(12,4))
plt.scatter(hour,OrderCount)
plt.xlabel('Hours')
plt.ylabel('No. of Orders')
plt.title('Orders by Hours')
plt.show()
```



[23]:
```
#around 12noon and 7pm
```

What products are most often sold together?

[24]:
```
df.head()
```

[24]:
```
   Order ID               Product  Quantity Ordered  Price Each  \
0    295665    Macbook Pro Laptop                 1     1700.00
1    295666    LG Washing Machine                 1      600.00
2    295667  USB-C Charging Cable                 1       11.95
3    295668      27in FHD Monitor                 1      149.99
4    295669  USB-C Charging Cable                 1       11.95

            Order Date                        Purchase Address     month  \
0  2019-12-30 00:01:00  136 Church St, New York City, NY 10001  December
1  2019-12-29 07:03:00     562 2nd St, New York City, NY 10001  December
2  2019-12-12 18:21:00    277 Main St, New York City, NY 10001  December
3  2019-12-22 15:13:00     410 6th St, San Francisco, CA 94016  December
4  2019-12-18 12:38:00           43 Hill St, Atlanta, GA 30301  December

     sales           city
0  1700.00  New York City
1   600.00  New York City
2    11.95  New York City
3   149.99  San Francisco
4    11.95        Atlanta
```

[25]:
```
df['Order ID'].duplicated().sum()
```

[25]:
```
7249
```

[26]:
```
ProductByOrder = df.groupby('Order ID').agg(Products=('Product',lambda x: ','.
↪join(x)) \
                                           ,ProductCount=('Product','count')).
↪reset_index()

MultipleProductByOrder =␣
↪ProductByOrder[ProductByOrder['ProductCount']>1][['Order ID','Products']]

MultipleProductByOrder.groupby('Products').agg(CountOfOrders=('Order␣
↪ID','count')) \
                      .sort_values('CountOfOrders',ascending=False).
↪reset_index().iloc[:5]
```

[26]:
```
                            Products  CountOfOrders
0       iPhone,Lightning Charging Cable           886
1     Google Phone,USB-C Charging Cable           857
2                iPhone,Wired Headphones           361
3  Vareebadd Phone,USB-C Charging Cable           312
4          Google Phone,Wired Headphones           303
```

[27]:
```
# iPhone with Lightning Charging Cable most often sold together (886 times)
# followed by Google Phone with USB-C Charging Cable (857 times)
```

What product sold the most? Why do you think it sold the most?

[28]:
```
df.head()
```

[28]:

	Order ID	Product	Quantity Ordered	Price Each	Order Date	Purchase Address	month	sales	city
0	295665	Macbook Pro Laptop	1	1700.00	2019-12-30 00:01:00	136 Church St, New York City, NY 10001	December	1700.00	New York City
1	295666	LG Washing Machine	1	600.00	2019-12-29 07:03:00	562 2nd St, New York City, NY 10001	December	600.00	New York City
2	295667	USB-C Charging Cable	1	11.95	2019-12-12 18:21:00	277 Main St, New York City, NY 10001	December	11.95	New York City
3	295668	27in FHD Monitor	1	149.99	2019-12-22 15:13:00	410 6th St, San Francisco, CA 94016	December	149.99	San Francisco
4	295669	USB-C Charging Cable	1	11.95	2019-12-18 12:38:00	43 Hill St, Atlanta, GA 30301	December	11.95	Atlanta

[29]:
```
df.groupby('Product').agg(TotalQuantity=('Quantity Ordered','sum')).\
sort_values('TotalQuantity',ascending=False).reset_index().iloc[:5]
```

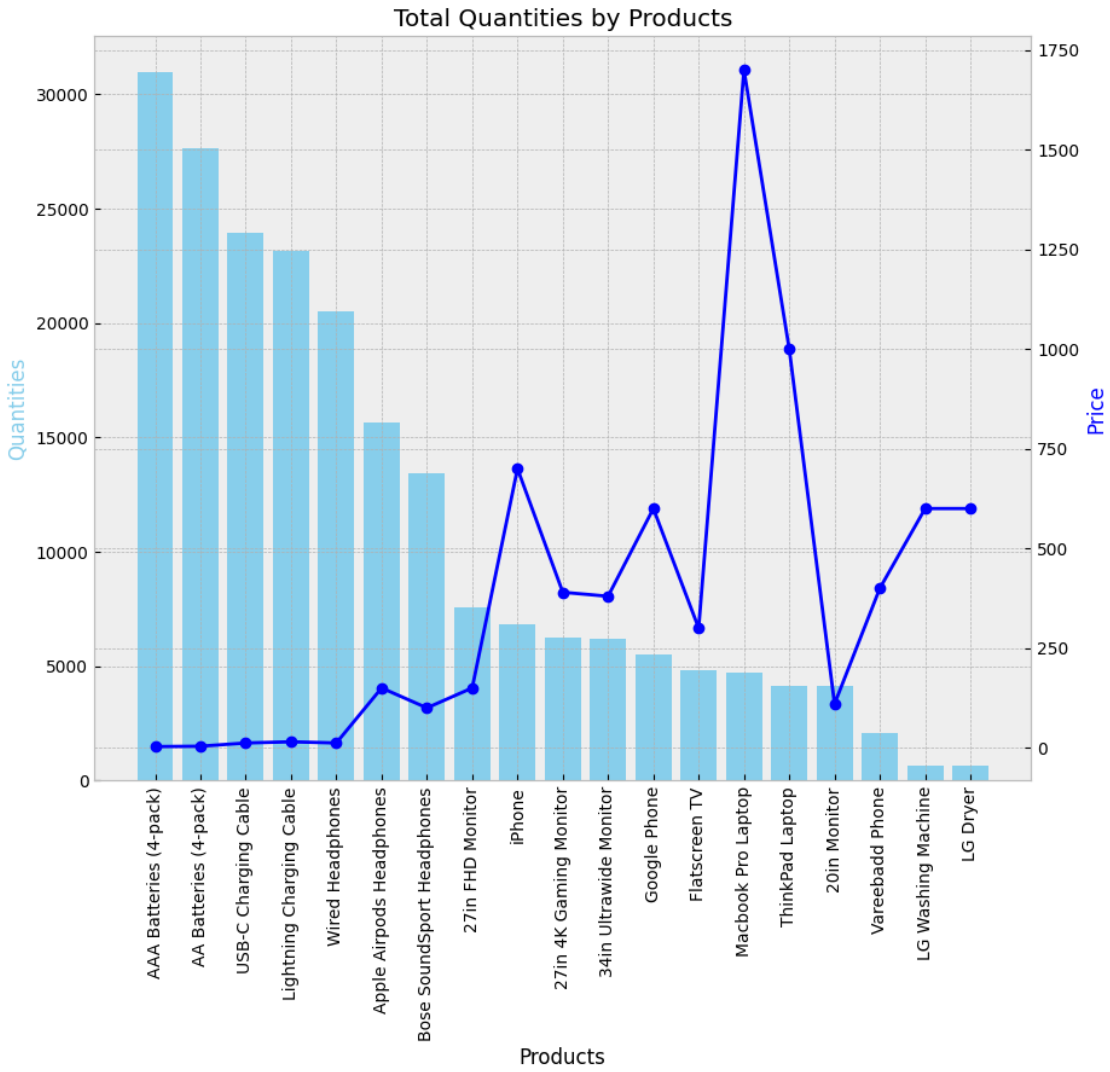
[29]:

	Product	TotalQuantity
0	AAA Batteries (4-pack)	30986
1	AA Batteries (4-pack)	27615
2	USB-C Charging Cable	23931
3	Lightning Charging Cable	23169
4	Wired Headphones	20524

[30]:
```
ProductsByQuantity = df.groupby('Product').agg(TotalQuantity=('Quantity␣
↪Ordered','sum'),Price=('Price Each','mean')) \

                                                .
↪sort_values('TotalQuantity',ascending=False).reset_index()

fig,ax1 = plt.subplots(figsize=(10, 8))

ax1.bar(ProductsByQuantity['Product'], ProductsByQuantity['TotalQuantity'],␣
↪color='skyblue')
```

```
ax1.set_xlabel('Products')
ax1.set_xticklabels(ProductsByQuantity['Product'],rotation=90)
ax1.set_ylabel('Quantities',color='skyblue')
ax1.set_title('Total Quantities by Products')

ax2 = ax1.twinx()
ax2.plot(ProductsByQuantity['Product'], ProductsByQuantity['Price'], color='b',␣
 ↪marker='o')
ax2.set_ylabel('Price',color='b')

plt.show()
```

```
C:\Users\atish\AppData\Local\Temp\ipykernel_8984\81398722.py:8: UserWarning:
FixedFormatter should only be used together with FixedLocator
  ax1.set_xticklabels(ProductsByQuantity['Product'],rotation=90)
```



[31]:
```
# AAA Batteries(4-pack) sold the most (total quantities : 30986)
# One possible reason : Price is the lowest among all products
```