Electronic Products Sales Analysis

June 18, 2023

0.1 Importing Libraries

[1]:

```
import os
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
```

[2]:

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

0.2 Merging 12 Month Sales Data into a single csv file

[3]:

```
path=r'''C:\Users\ebint\Downloads\Pandas-Data-Science-Tasks-master\
Pandas-Data-Science-Tasks-master\SalesAnalysis\Sales_Data'''
path=path.replace("\\","/")
files=[files  for files in os.listdir(path)]

df=pd.DataFrame()

for file in files:
    temp_df=pd.read_csv(path+"\\"+file)
    df= pd.concat([df,temp_df])

df.shape
```

[3]:

```
(186850, 6)
```

[4]:

```
df.sample()
```

[4]:

```
     Order ID                 Product Quantity Ordered Price Each  \
9046   149858  AAA Batteries (4-pack)                1       2.99

          Order Date               Purchase Address
9046  01/25/19 13:54  43 Elm St, Portland, OR 97035
```

[5]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 186850 entries, 0 to 11685
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
```

```
[6]: # Checking for null values
```

```
[7]: df.isnull().sum()
```

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

```
[8]: df = df.dropna()
```

0.3 Question 1: What were the best month for sales and how much did they earn that month

```
[9]: df = df[df["Order Date"].str[0:2] !="Or"] # removing incorrect months
```

```
[10]: # Augmenting the data by creating new columns

      df["Month"]=df["Order Date"].str[0:2].astype("int16")
      df.head(2)
```

```
[10]:   Order ID                     Product Quantity Ordered Price Each  \
      0   176558        USB-C Charging Cable                2      11.95   
      2   176559  Bose SoundSport Headphones                1      99.99   

           Order Date                      Purchase Address  Month  
      0  04/19/19 08:46          917 1st St, Dallas, TX 75001      4  
      2  04/07/19 22:30     682 Chestnut St, Boston, MA 02215      4  
```

```
[11]: df["Quantity Ordered"] =df["Quantity Ordered"].astype("int")
```

[12]:

```
df["Price Each"] = df["Price Each"].astype("float")
```

[13]:

```
df["Sales"]=df["Quantity Ordered"] * df["Price Each"]
```

[14]:

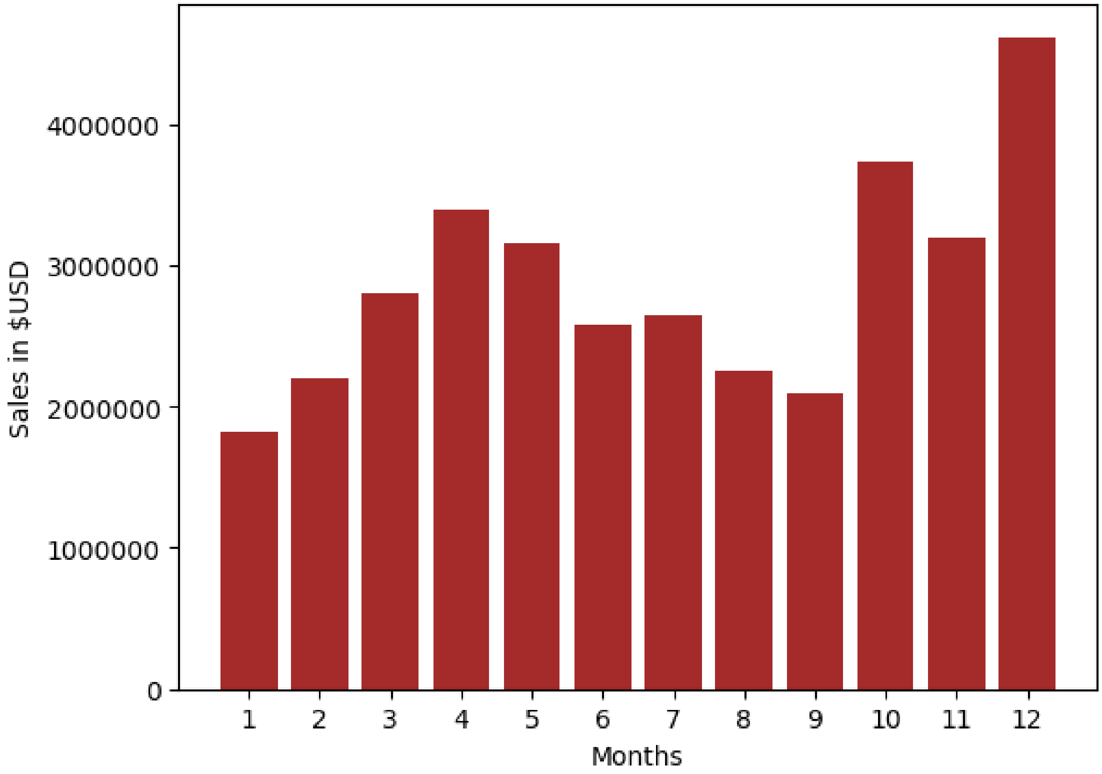
```
df.head(2)
```

[14]:

```
  Order ID                    Product  Quantity Ordered  Price Each  \
0   176558       USB-C Charging Cable                 2       11.95
2   176559  Bose SoundSport Headphones                1       99.99

       Order Date                      Purchase Address  Month  Sales
0  04/19/19 08:46         917 1st St, Dallas, TX 75001      4  23.90
2  04/07/19 22:30    682 Chestnut St, Boston, MA 02215      4  99.99
```

[15]:

```
x = range(1,13) # Months
y = df.groupby("Month")["Sales"].sum() # Total sales / Month

plt.bar(x,y,color="brown")
plt.xticks(x)
plt.xlabel("Months")
plt.ylabel("Sales in $USD")
plt.ticklabel_format(useOffset=False, style='plain')
plt.show()
```



0.4 Inferences

[16]:
```
# 1) Based on the graph, we can observe that the fourth quarter, which␣
 ↪corresponds to the months of October to December,
#    exhibits the highest sales. This can be attributed to the Christmas␣
 ↪season, which typically drives increased consumer
#    spending.

# 2) Conversely, the initial months of the year display noticeably lower sales,␣
 ↪primarily due to the reduced financial capacity
#    of individuals.
```

0.5 Question 2: What states had the highest number of sales

[17]:
```
# create a new column with cities
```

[18]:
```
def get_city(address):
    return address.split(",")[1]

df["City"] = df["Purchase Address"].apply(lambda x: get_city(x))
df.head(2)
```

[18]:
```
   Order ID                     Product  Quantity Ordered  Price Each  \
0    176558        USB-C Charging Cable                 2       11.95
2    176559  Bose SoundSport Headphones                 1       99.99

        Order Date                      Purchase Address  Month  Sales     City
0   04/19/19 08:46          917 1st St, Dallas, TX 75001      4  23.90   Dallas
2   04/07/19 22:30     682 Chestnut St, Boston, MA 02215      4  99.99   Boston
```

[19]:
```
city_df=df.groupby("City").sum().sort_values(["Sales"])
```

[20]:
```
df.groupby("City").sum()["Sales"]
```

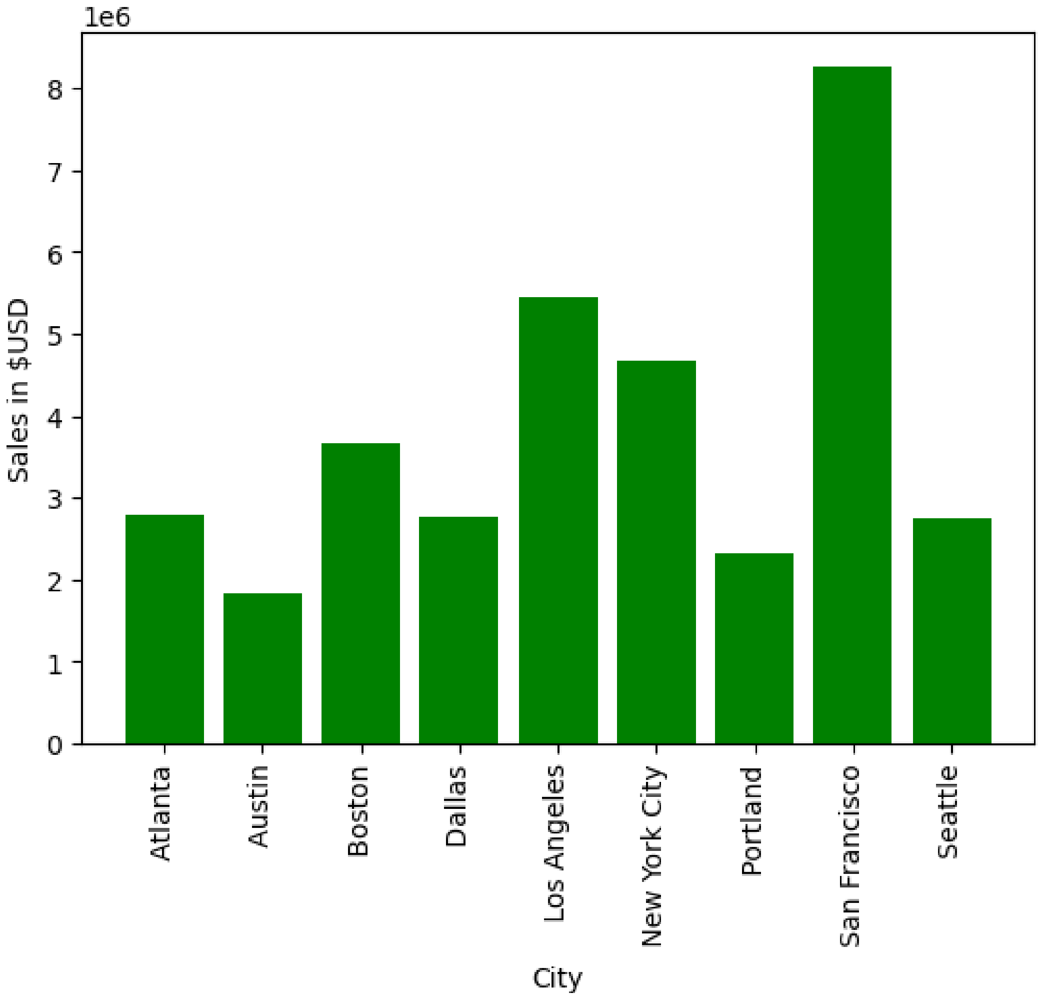
[20]:
```
City
 Atlanta          2795498.58
 Austin           1819581.75
 Boston           3661642.01
 Dallas           2767975.40
 Los Angeles      5452570.80
 New York City    4664317.43
 Portland         2320490.61
 San Francisco    8262203.91
 Seattle          2747755.48
Name: Sales, dtype: float64
```

[21]:

```python
pd.set_option('display.float_format', lambda x: '%.3f' % x)
```

[22]:

```python
x = df.groupby("City").sum().index
y = df.groupby("City").sum()["Sales"] # Total sales

plt.bar(x,y,color="green")
plt.xticks(x, rotation="vertical",size=10)
#plt.ticklabel_format(axis='y', style='plain')
plt.xlabel("City")
plt.ylabel("Sales in $USD")
plt.show()
```



0.5.1 Inference:

[23]:
```
# 1) Sanfranciso, Los Angels and New York city are the top three states with␣
  ↪highest number of sales

# 2) Overall, analyzing sales data across cities provides valuable insights␣
  ↪into market performance, regional trends,
#    customer preferences, and competition. By leveraging this information,␣
  ↪businesses can make informed decisions,
#    optimize strategies, and allocate resources effectively to drive further␣
  ↪growth and success.
```

0.6 Question 3: At what time should the company display advertisments to maximize the likelyhood of customers buying product

[24]:
```
# converting order date to date time format
df["Order Date"]=pd.to_datetime(df["Order Date"])
df.head(2)
```

[24]:
```
  Order ID                    Product  Quantity Ordered  Price Each  \
0   176558       USB-C Charging Cable                 2      11.950
2   176559  Bose SoundSport Headphones                 1      99.990

           Order Date                    Purchase Address  Month  Sales  \
0 2019-04-19 08:46:00        917 1st St, Dallas, TX 75001      4 23.900
2 2019-04-07 22:30:00  682 Chestnut St, Boston, MA 02215      4 99.990

      City
0   Dallas
2   Boston
```

[25]:
```
df["Hour"]=df["Order Date"].dt.hour
```

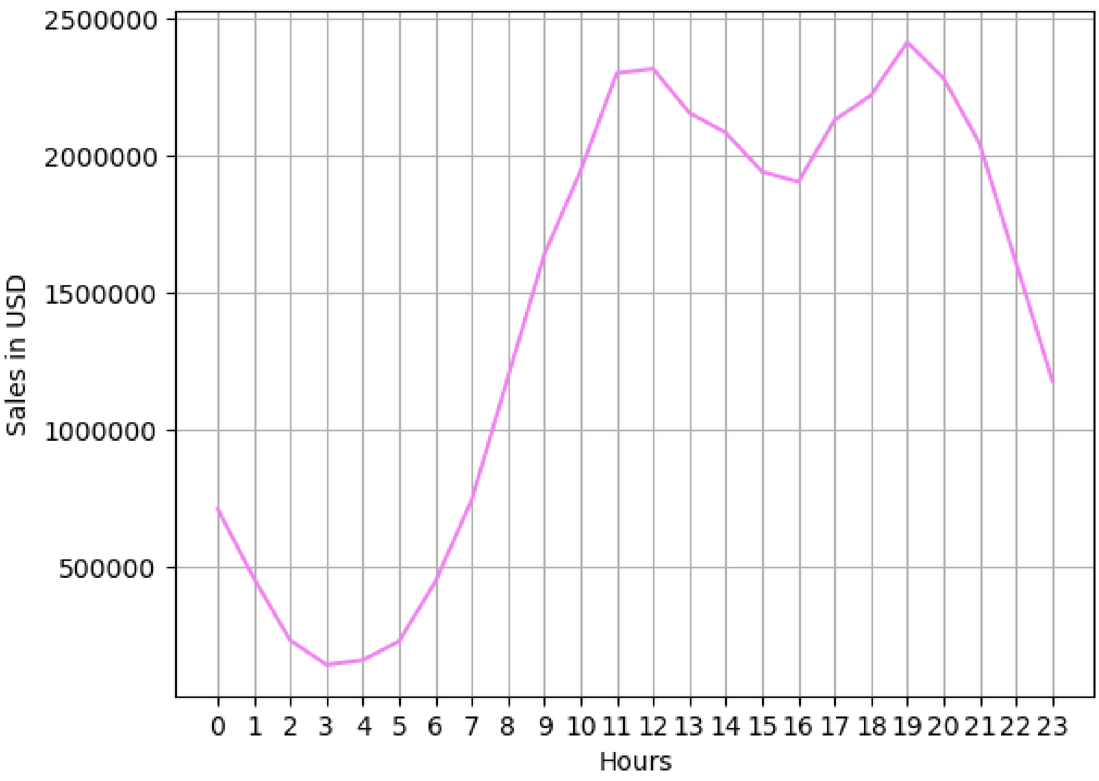
[26]:
```
df.sample(5)
```

[26]:
```
      Order ID                    Product  Quantity Ordered  Price Each  \
9062    159154       USB-C Charging Cable                 1      11.950
8128    184318     34in Ultrawide Monitor                 1     379.990
10357   269248      AA Batteries (4-pack)                 3       3.840
984     249098           Wired Headphones                 1      11.990
14038   292215       USB-C Charging Cable                 1      11.950

               Order Date                      Purchase Address  Month   Sales  \
9062  2019-02-08 07:49:00         624 Ridge St, Dallas, TX 75001      2  11.950
8128  2019-04-02 12:45:00  517 6th St, San Francisco, CA 94016      4 379.990
10357 2019-10-21 19:59:00           907 9th St, Dallas, TX 75001     10  11.520
984   2019-09-22 21:31:00          415 9th St, Seattle, WA 98101      9  11.990
```

```
14038 2019-11-10 18:40:00  193 Elm St, San Francisco, CA 94016     11  11.950

                City  Hour
9062          Dallas     7
8128   San Francisco    12
10357         Dallas    19
984          Seattle    21
14038  San Francisco    18
```

[27]:

```
x=df.groupby("Hour").sum().index
y=df.groupby("Hour").sum()["Sales"]

plt.plot(x,y,color="violet")
plt.xticks(x,size=10)
plt.ticklabel_format(axis='y', style='plain')
plt.xlabel("Hours")
plt.ylabel("Sales in USD")
plt.grid()
plt.show()
```



0.6.1 Inference:

[28]:
```
# 1) The higher sales figures during the morning (6 AM to 12 PM) and evening to␣
↪early night (4 PM to 8 PM) suggest that
#    these time periods are the peak sales periods. Customers are more active␣
↪during these hours and are likely to make
#    more purchases.


# 2) The sales pattern indicates that customers may prefer to shop during␣
↪specific times of the day, aligning with their
#    daily routines. Mornings are typically associated with starting the day␣
↪and completing tasks, while evenings are often
#    associated with leisure time and winding down. Understanding these␣
↪patterns can help businesses allocate resources and
#    tailor marketing efforts to target customers during these peak periods.
```

0.7 Question 4: What are the frequently purchased products

[29]:
```
df["Product"].value_counts().head(5)
```

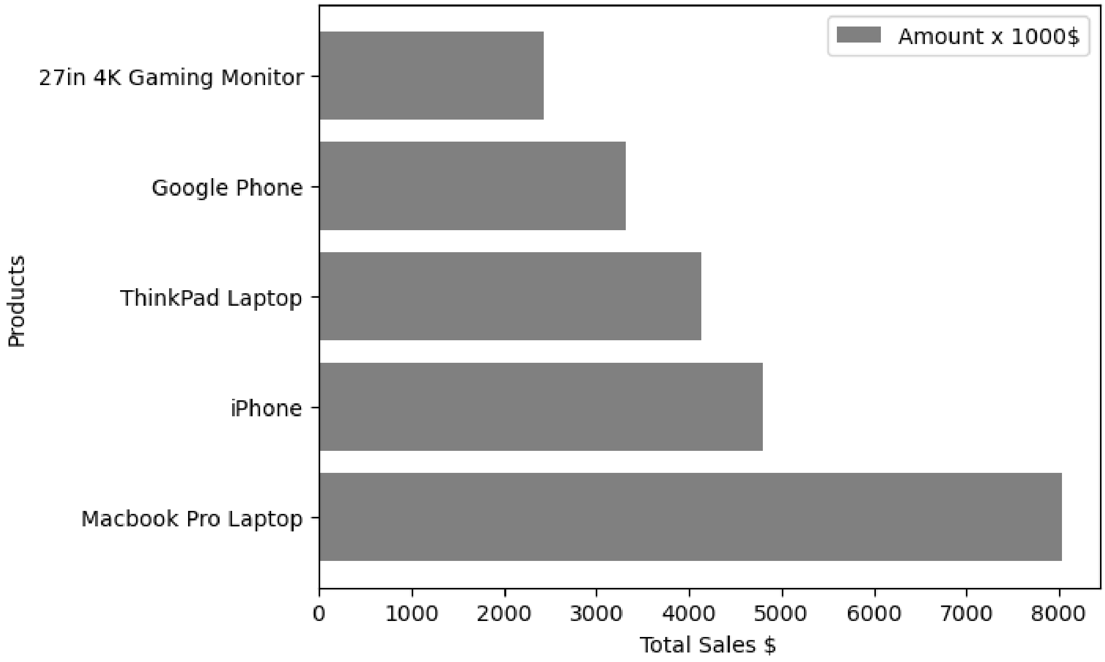
[29]:
```
USB-C Charging Cable        21903
Lightning Charging Cable    21658
AAA Batteries (4-pack)      20641
AA Batteries (4-pack)       20577
Wired Headphones            18882
Name: Product, dtype: int64
```

0.7.1 Inference:

[30]:
```
# Products that have a short lifespan or products that wear out quickly tend to␣
↪be sold more frequently.
# A prime example of such products is batteries.
```

0.8 Question 5: What products generates most revenue

[31]:
```
x = df.groupby("Product").sum().sort_values("Sales", ascending=False).head().
↪index
y = df.groupby("Product").sum().sort_values("Sales", ascending=False).
↪head()["Sales"]/1000

plt.barh(x,y,color="grey",label="Amount x 1000$")
plt.legend()
plt.ylabel("Products")
plt.xlabel("Total Sales $")
plt.ticklabel_format(axis='x', style='plain')
plt.show()
```



[32]:
```
df.groupby("Product").sum().sort_values("Sales", ascending=False).
↪head()["Sales"]
```

[32]:
```
Product
Macbook Pro Laptop       8037600.000
iPhone                   4794300.000
ThinkPad Laptop          4129958.700
Google Phone             3319200.000
27in 4K Gaming Monitor   2435097.560
Name: Sales, dtype: float64
```

0.8.1 Inference:

[33]:
```
# 1) Products like laptops, phones, and monitors, particularly those from␣
↪Apple, demonstrate higher sales revenue.

# 2) Increase the availability of these high-demand products by expanding␣
↪distribution channels. Consider selling
# through multiple platforms, both online and offline, to reach a wider␣
↪customer base,
```

0.9 Question 6: What Products are most often sold together

[34]:
```
df.head(5)
```

[34]:
```
  Order ID                     Product  Quantity Ordered  Price Each  \
0   176558        USB-C Charging Cable                 2      11.950
2   176559  Bose SoundSport Headphones                 1      99.990
3   176560                Google Phone                 1     600.000
4   176560            Wired Headphones                 1      11.990
5   176561            Wired Headphones                 1      11.990

           Order Date                      Purchase Address  Month   Sales  \
0 2019-04-19 08:46:00          917 1st St, Dallas, TX 75001      4  23.900
2 2019-04-07 22:30:00     682 Chestnut St, Boston, MA 02215      4  99.990
3 2019-04-12 14:38:00  669 Spruce St, Los Angeles, CA 90001      4 600.000
4 2019-04-12 14:38:00  669 Spruce St, Los Angeles, CA 90001      4  11.990
5 2019-04-30 09:27:00     333 8th St, Los Angeles, CA 90001      4  11.990

            City  Hour
0         Dallas     8
2         Boston    22
3    Los Angeles    14
4    Los Angeles    14
5    Los Angeles     9
```

[35]:
```
# When you set keep=False as a parameter in the .duplicated() method in pandas, it marks all occurrences of duplicated rows as True.
# This means that all duplicated rows are considered duplicates, and no occurrences are marked as unique.

# considering only duplicated rows by order id
new_df=df[df["Order ID"].duplicated(keep=False)]
```

[36]:
```
new_df.head()
```

[36]:
```
   Order ID                     Product  Quantity Ordered  Price Each  \
3    176560                Google Phone                 1     600.000
4    176560            Wired Headphones                 1      11.990
18   176574                Google Phone                 1     600.000
19   176574        USB-C Charging Cable                 1      11.950
30   176585  Bose SoundSport Headphones                 1      99.990

            Order Date                      Purchase Address  Month   Sales  \
3  2019-04-12 14:38:00  669 Spruce St, Los Angeles, CA 90001      4 600.000
4  2019-04-12 14:38:00  669 Spruce St, Los Angeles, CA 90001      4  11.990
18 2019-04-03 19:42:00     20 Hill St, Los Angeles, CA 90001      4 600.000
19 2019-04-03 19:42:00     20 Hill St, Los Angeles, CA 90001      4  11.950
```

```
30 2019-04-07 11:31:00     823 Highland St, Boston, MA 02215      4  99.990

             City  Hour
3     Los Angeles    14
4     Los Angeles    14
18    Los Angeles    19
19    Los Angeles    19
30         Boston    11
```

[37]:

```
# group dataset by order id, then taking product column and combining multiple␣
 ↪products to one single entity on a new column called combined product

new_df["Combined Product"] = new_df.groupby("Order ID")["Product"].
 ↪transform(lambda x: ",".join(x))
```

[38]:

```
new_df.head()
```

[38]:

```
   Order ID                     Product  Quantity Ordered  Price Each  \
3    176560                Google Phone                 1     600.000
4    176560            Wired Headphones                 1      11.990
18   176574                Google Phone                 1     600.000
19   176574        USB-C Charging Cable                 1      11.950
30   176585  Bose SoundSport Headphones                 1      99.990

             Order Date                      Purchase Address  Month   Sales  \
3  2019-04-12 14:38:00  669 Spruce St, Los Angeles, CA 90001      4 600.000
4  2019-04-12 14:38:00  669 Spruce St, Los Angeles, CA 90001      4  11.990
18 2019-04-03 19:42:00     20 Hill St, Los Angeles, CA 90001      4 600.000
19 2019-04-03 19:42:00     20 Hill St, Los Angeles, CA 90001      4  11.950
30 2019-04-07 11:31:00     823 Highland St, Boston, MA 02215      4  99.990

             City  Hour                                   Combined Product
3     Los Angeles    14                      Google Phone,Wired Headphones
4     Los Angeles    14                      Google Phone,Wired Headphones
18    Los Angeles    19                  Google Phone,USB-C Charging Cable
19    Los Angeles    19                  Google Phone,USB-C Charging Cable
30         Boston    11  Bose SoundSport Headphones,Bose SoundSport Hea…
```

[39]:

```
# removing rows with duplicated order id

new_df=new_df[["Order ID","Combined Product"]].drop_duplicates()
```

[40]:

```
new_df["Combined Product"].value_counts()[:5]
```

[40]:

```
iPhone,Lightning Charging Cable          882
Google Phone,USB-C Charging Cable        856
iPhone,Wired Headphones                  361
```

```
Vareebadd Phone,USB-C Charging Cable    312
Google Phone,Wired Headphones           303
Name: Combined Product, dtype: int64
```

0.9.1 Inference:

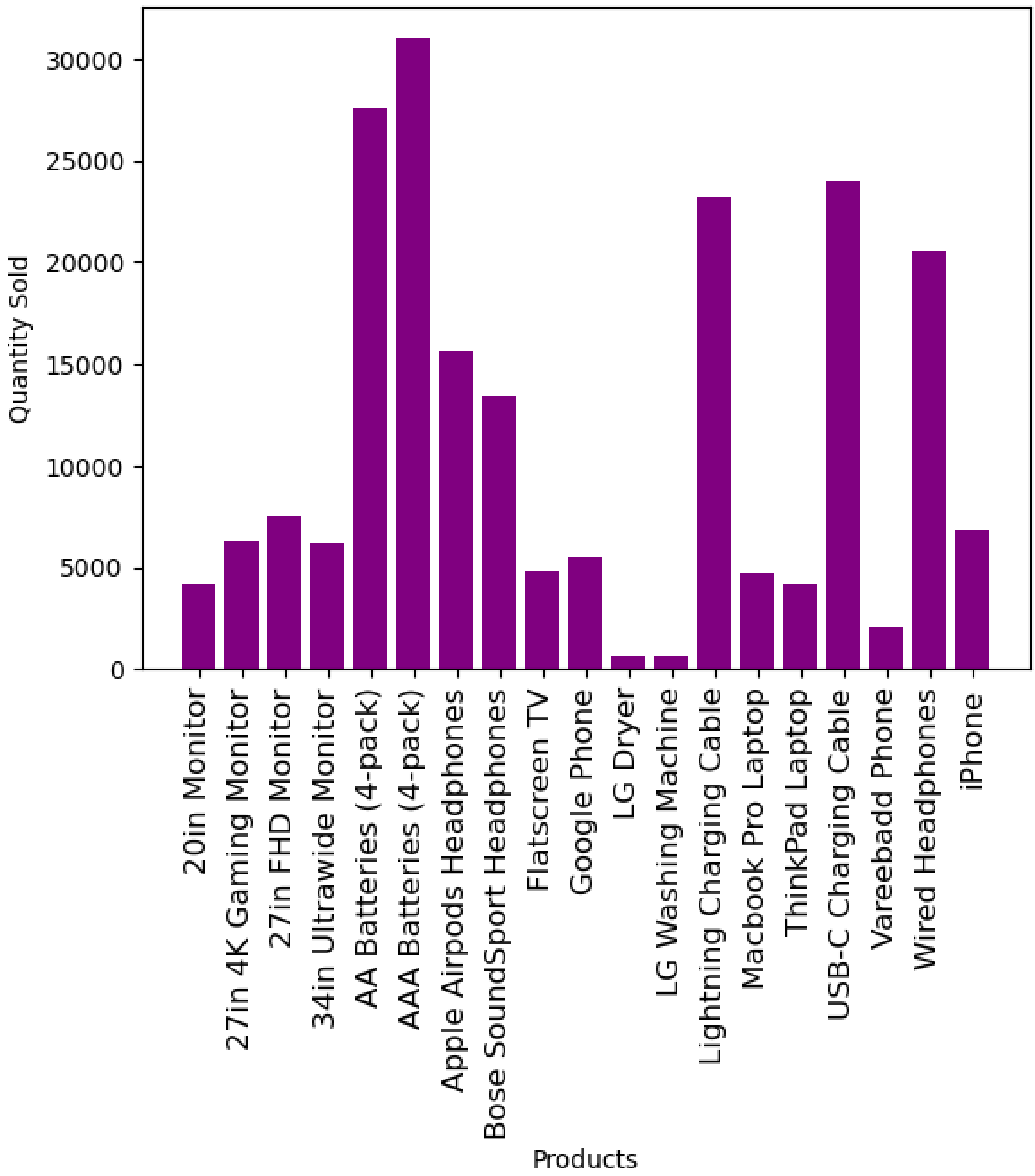
[41]:

```
# 1) These product combinations indicate a strong trend of customers buying␣
 ↪smartphones along with compatible charging cables
#    and headphones.

# 2) Leveraging this factor business can run targeted promotions or discounts␣
 ↪on the popular product combinations.
# This can      include limited-time offers, buy-one-get-one deals, or␣
 ↪discounted prices when customers purchase specific combinations.
```

0.10 Question 7: What are the top-selling products

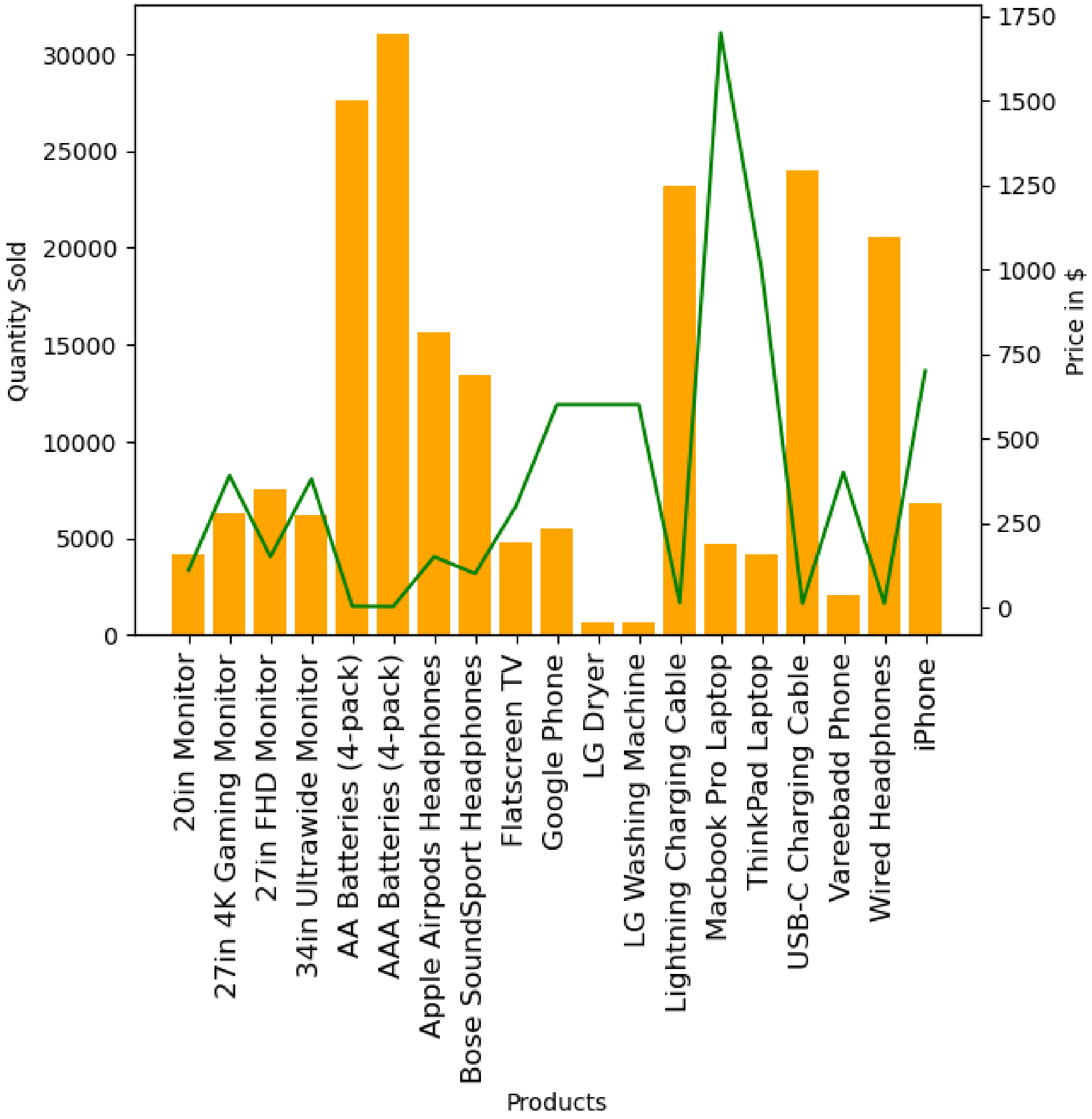
[42]:

```
x = [product for product, df in df.groupby("Product")]
y = df.groupby("Product")["Quantity Ordered"].sum()

plt.bar(x,y,color="purple")
plt.ylabel("Quantity Sold")
plt.xlabel("Products")
plt.xticks(x, rotation="vertical",size=12)
plt.ticklabel_format(axis='y', style='plain')
plt.show()
```



[43]:
```
# comparing products sold with their prices

x = [product for product, df in df.groupby("Product")]
y = df.groupby("Product")["Quantity Ordered"].sum()
z = df.groupby("Product")["Price Each"].mean()

fig, ax1 = plt.subplots()
ax1.bar(x, y,color="orange")
```

```python
ax1.set_xlabel('Products')
ax1.set_ylabel('Quantity Sold')
plt.xticks(x, rotation="vertical",size=12)

# Create the second plot with y2
ax2 = ax1.twinx()
ax2.plot(x, z,color="green")
ax2.set_ylabel("Price in $")

plt.show()
```



0.10.1 Inference:

[44]:

```
# 1) Products that have lower prices, such as charging cables, tend to experience higher sales.

# 2) Despite their high prices, laptops, phones, and other commonly used devices tend
#    to have better sales due to their widespread usage

# 3) Products that have a short lifespan or products that wear out quickly tend to be sold more frequently.
#    A prime example of such products is batteries.

# 4) Advertising can be minimized to products that already possess a positive perception among customers
#    example Apple products
```