In [1]:
```python
import os
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

Merge 12 months of sales data into a single csv file

In [125]:
```python
files =[file for file in os.listdir("F:/EDA_projects/Sales_Analysis/SalesAnalysis/Sales_Dat
a")]
for file in files:
    print(file)
```

```
Sales_April_2019.csv
Sales_August_2019.csv
Sales_December_2019.csv
Sales_February_2019.csv
Sales_January_2019.csv
Sales_July_2019.csv
Sales_June_2019.csv
Sales_March_2019.csv
Sales_May_2019.csv
Sales_November_2019.csv
Sales_October_2019.csv
Sales_September_2019.csv
```

In [141]:
```python
path = "F:/EDA_projects/Sales_Analysis/SalesAnalysis/Sales_Data"

#blank dataframe
all_data = pd.DataFrame()

for file in files:
    current_df = pd.read_csv(path+"/"+file)
    all_data = pd.concat([all_data, current_df])

all_data.shape
```

Out[141]: (186850, 6)

convert it into dataset

In [ ]:
```python
all_data.to_csv('F:/EDA_projects/Sales_Analysis/SalesAnalysis/Sales_Data/all_data.csv',index
=False)
```

Data cleaning and formatting

In [142]:
```python
all_data.dtypes
```

Out[142]:
```
Order ID            object
Product             object
Quantity Ordered    object
Price Each          object
Order Date          object
Purchase Address    object
dtype: object
```

In [128]:
```python
all_data.head()
```

Out[128]:

	Order ID	Product	Quantity Ordered	Price Each	Order Date	Purchase Address
0	176558	USB-C Charging Cable	2	11.95	04/19/19 08:46	917 1st St, Dallas, TX 75001
1	NaN	NaN	NaN	NaN	NaN	NaN
2	176559	Bose SoundSport Headphones	1	99.99	04/07/19 22:30	682 Chestnut St, Boston, MA 02215
3	176560	Google Phone	1	600	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001
4	176560	Wired Headphones	1	11.99	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001

In [129]:
```python
all_data.isnull().sum()
```

Out[129]:
```
Order ID            585
Product             585
Quantity Ordered    585
Price Each          585
Order Date          585
Purchase Address    585
dtype: int64
```

In [143]:
```python
all_data = all_data.dropna(how='all')
all_data.shape
```

Out[143]: (186305, 6)

What is the best month for sale?

In [10]:
```python
'04/19/19 08:46'.split('/')[0]
```

Out[10]: '04'

In [144]:
```python
def month(x):
    return x.split('/')[0]
```

add month col

In [145]:
```python
all_data['Month']=all_data['Order Date'].apply(month)
```

In [134]:
```python
all_data.dtypes
```

Out[134]:
```
Order ID            object
Product             object
Quantity Ordered    object
Price Each          object
Order Date          object
Purchase Address    object
Month               object
dtype: object
```

In [147]:
```python
all_data['Month'].unique()
```

Out[147]:
```
array(['04', '05', 'Order Date', '08', '09', '12', '01', '02', '03', '07',
       '06', '11', '10'], dtype=object)
```

In [148]:
```python
filter=all_data['Month']=='Order Date'
len(all_data[~filter])
```

Out[148]: 185950

In [149]:
```python
all_data=all_data[~filter]
```

In [150]:
```python
all_data.shape
```

Out[150]: (185950, 7)

In [151]:
```python
all_data.head()
```

Out[151]:

	Order ID	Product	Quantity Ordered	Price Each	Order Date	Purchase Address	Month
0	176558	USB-C Charging Cable	2	11.95	04/19/19 08:46	917 1st St, Dallas, TX 75001	04
2	176559	Bose SoundSport Headphones	1	99.99	04/07/19 22:30	682 Chestnut St, Boston, MA 02215	04
3	176560	Google Phone	1	600	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001	04
4	176560	Wired Headphones	1	11.99	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001	04
5	176561	Wired Headphones	1	11.99	04/30/19 09:27	333 8th St, Los Angeles, CA 90001	04

In [152]:
```python
all_data['Month']=all_data['Month'].astype(int)
```

In [29]:
```python
all_data.dtypes
```

Out[29]:
```
Order ID            object
Product             object
Quantity Ordered    object
Price Each          object
Order Date          object
Purchase Address    object
Month                int32
dtype: object
```

In [153]:
```python
all_data['Price Each']=all_data['Price Each'].astype(float)
```

In [154]:
```python
all_data['Quantity Ordered']=all_data['Quantity Ordered'].astype(int)
```

In [155]:
```python
all_data['sales']=all_data['Quantity Ordered']*all_data['Price Each']
all_data.head(5)
```

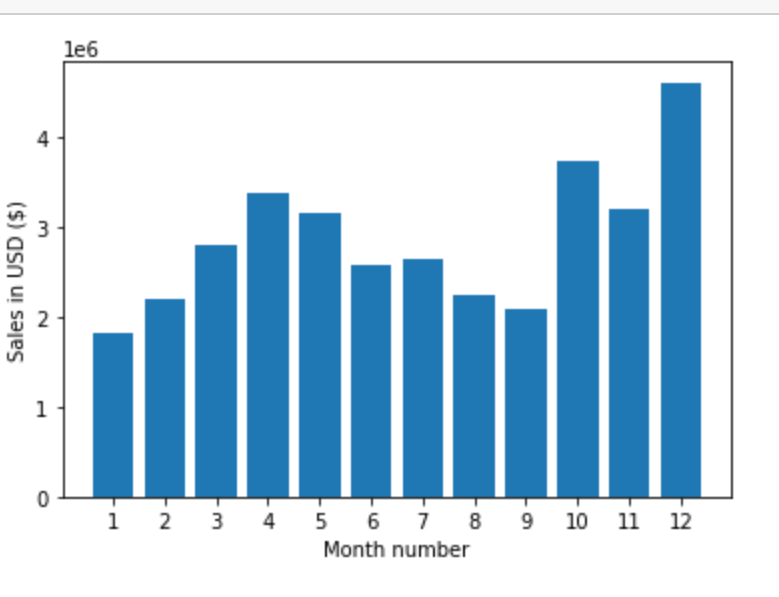
Out[155]:

	Order ID	Product	Quantity Ordered	Price Each	Order Date	Purchase Address	Month	sales
0	176558	USB-C Charging Cable	2	11.95	04/19/19 08:46	917 1st St, Dallas, TX 75001	4	23.90
2	176559	Bose SoundSport Headphones	1	99.99	04/07/19 22:30	682 Chestnut St, Boston, MA 02215	4	99.99
3	176560	Google Phone	1	600.00	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001	4	600.00
4	176560	Wired Headphones	1	11.99	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001	4	11.99
5	176561	Wired Headphones	1	11.99	04/30/19 09:27	333 8th St, Los Angeles, CA 90001	4	11.99

In [156]:
```python
all_data.groupby('Month')['sales'].sum()
```

Out[156]:
```
Month
1     1.822257e+06
2     2.202022e+06
3     2.807100e+06
4     3.390670e+06
5     3.152607e+06
6     2.577802e+06
7     2.647776e+06
8     2.244468e+06
9     2.097560e+06
10    3.736727e+06
11    3.199603e+06
12    4.613443e+06
Name: sales, dtype: float64
```

In [157]:
```python
months=range(1,13)
plt.bar(months,all_data.groupby('Month')['sales'].sum())
plt.xticks(months)
plt.ylabel('Sales in USD ($)')
plt.xlabel('Month number')
plt.show()
```



Which city has max order

In [43]:
```python
'917 1st St, Dallas, TX 75001'.split(',')[1]
```

Out[43]: ' Dallas'

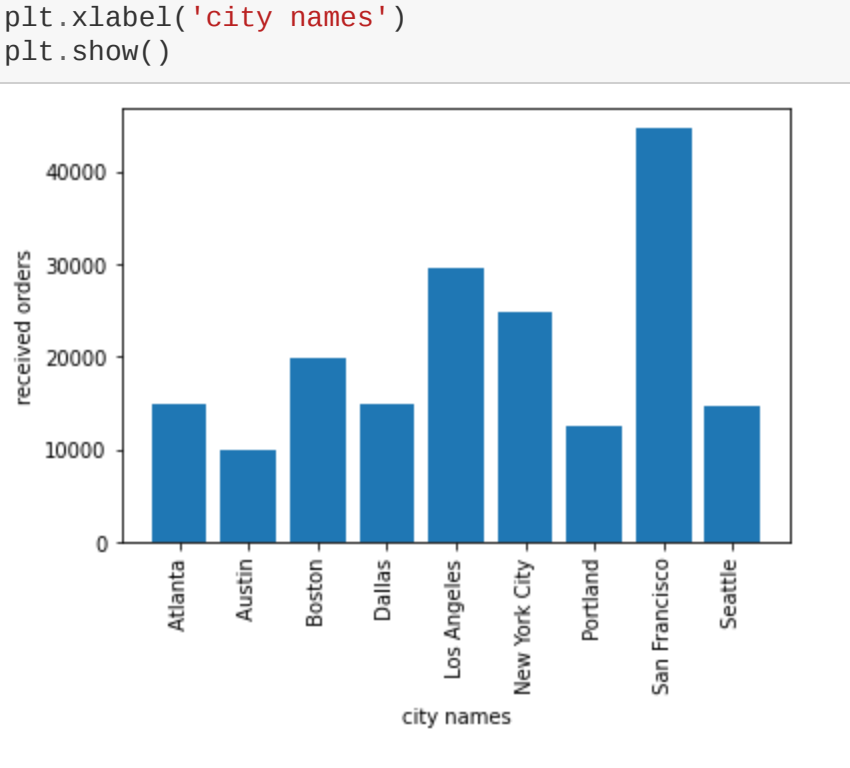
In [158]:
```python
def city(x):
    return x.split(',')[1]
```

In [159]:
```python
all_data['city']=all_data['Purchase Address'].apply(city)
```

In [160]:
```python
all_data.groupby('city')['city'].count()
```

Out[160]:
```
city
 Atlanta          14881
 Austin            9905
 Boston           19934
 Dallas           14820
 Los Angeles      29605
 New York City    24876
 Portland         12465
 San Francisco    44732
 Seattle          14732
Name: city, dtype: int64
```

In [161]:
```python
plt.bar(all_data.groupby('city')['city'].count().index,all_data.groupby('city')['city'].coun
t())
plt.xticks(rotation='vertical')
plt.ylabel('received orders')
plt.xlabel('city names')
plt.show()
```



What time should we display advertisements to maximise for product purchase?

In [59]:
```python
all_data['Order Date'][0].dtype
```

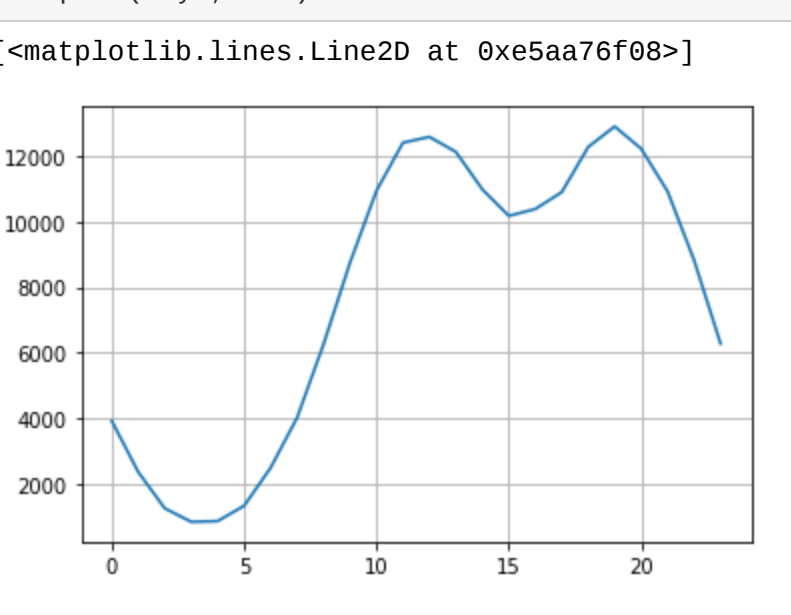
Out[59]: dtype('O')

In [162]:
```python
all_data['Hour'] = pd.to_datetime(all_data['Order Date']).dt.hour
```

In [163]:
```python
keys=[]
hour=[]
for key,hour_df in all_data.groupby('Hour'):
    keys.append(key)
    hour.append(len(hour_df))
```

In [164]:
```python
plt.grid()
plt.plot(keys,hour)
```

Out[164]: [<matplotlib.lines.Line2D at 0xe5aa76f08>]



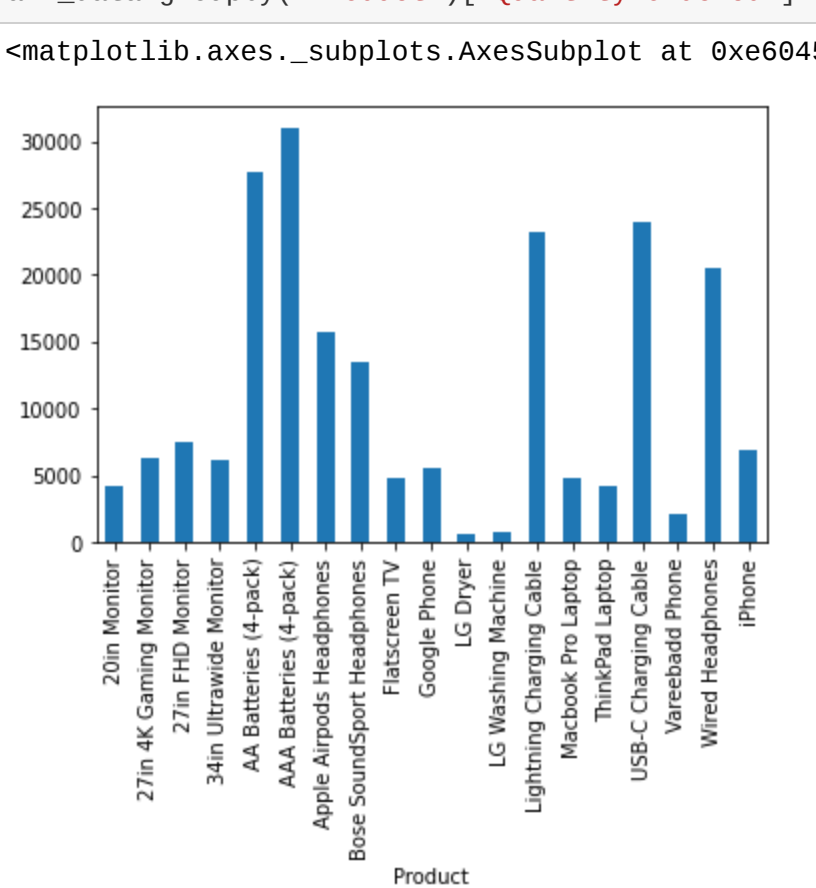
between 12pm and 7pm is probably the best time to advertise to maximise product purchase

In [ ]:

What product sold the most? & Why?

In [165]:
```python
all_data.groupby('Product')['Quantity Ordered'].sum().plot(kind='bar')
```

Out[165]: <matplotlib.axes._subplots.AxesSubplot at 0xe60459c48>



In [166]:
```python
all_data.groupby('Product')['Price Each'].mean()
```

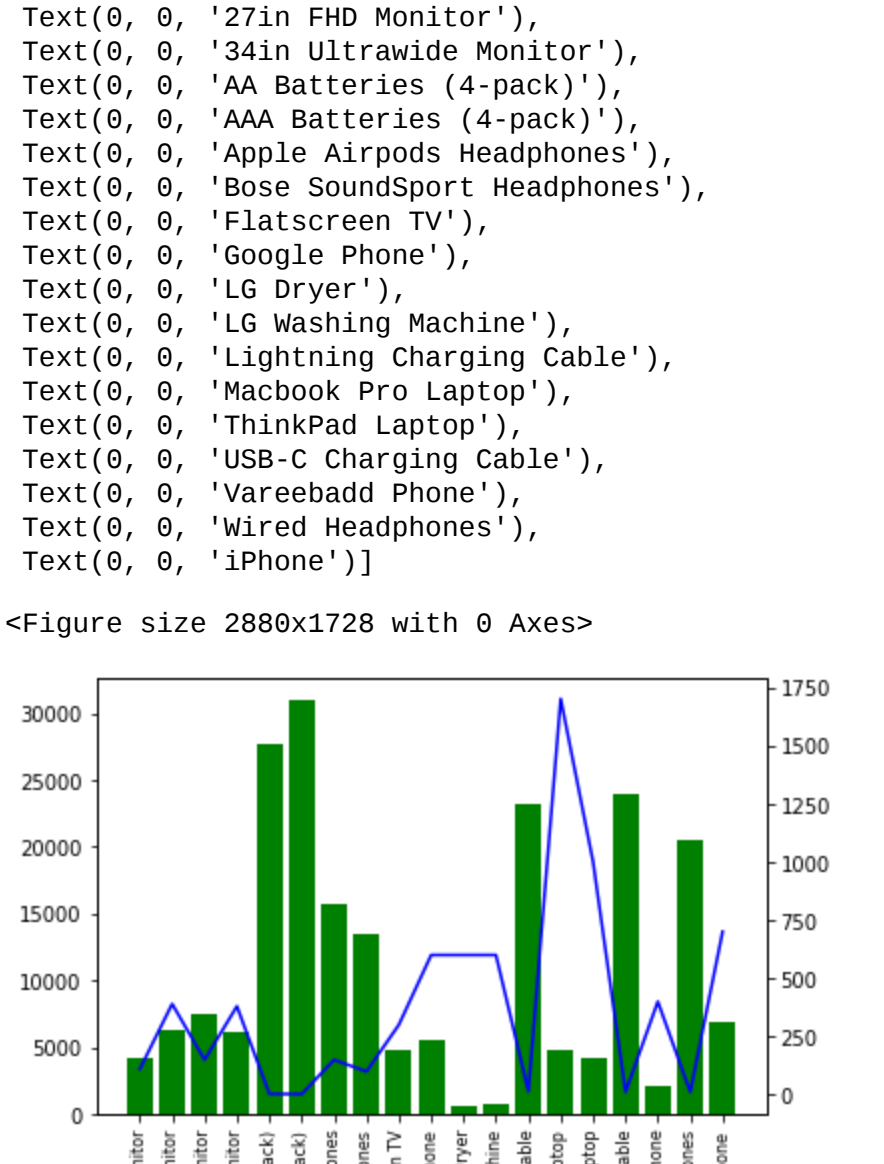
Out[166]:
```
Product
20in Monitor                   109.99
27in 4K Gaming Monitor         389.99
27in FHD Monitor               149.99
34in Ultrawide Monitor         379.99
AA Batteries (4-pack)            3.84
AAA Batteries (4-pack)           2.99
Apple Airpods Headphones       150.00
Bose SoundSport Headphones      99.99
Flatscreen TV                  300.00
Google Phone                   600.00
LG Dryer                       600.00
LG Washing Machine             600.00
Lightning Charging Cable        14.95
Macbook Pro Laptop            1700.00
ThinkPad Laptop                999.99
USB-C Charging Cable            11.95
Vareebadd Phone                400.00
Wired Headphones                11.99
iPhone                         700.00
Name: Price Each, dtype: float64
```

In [167]:
```python
products=all_data.groupby('Product')['Quantity Ordered'].sum().index
quantity=all_data.groupby('Product')['Quantity Ordered'].sum()
prices=all_data.groupby('Product')['Price Each'].mean()
```

In [168]:
```python
plt.figure(figsize=(40,24))
fig,ax1 = plt.subplots()
ax2=ax1.twinx()
ax1.bar(products, quantity, color='g')
ax2.plot(products, prices, 'b-')
ax1.set_xticklabels(products, rotation='vertical', size=8)
```

Out[168]:
```
[Text(0, 0, '20in Monitor'),
 Text(0, 0, '27in 4K Gaming Monitor'),
 Text(0, 0, '27in FHD Monitor'),
 Text(0, 0, '34in Ultrawide Monitor'),
 Text(0, 0, 'AA Batteries (4-pack)'),
 Text(0, 0, 'AAA Batteries (4-pack)'),
 Text(0, 0, 'Apple Airpods Headphones'),
 Text(0, 0, 'Bose SoundSport Headphones'),
 Text(0, 0, 'Flatscreen TV'),
 Text(0, 0, 'Google Phone'),
 Text(0, 0, 'LG Dryer'),
 Text(0, 0, 'LG Washing Machine'),
 Text(0, 0, 'Lightning Charging Cable'),
 Text(0, 0, 'Macbook Pro Laptop'),
 Text(0, 0, 'ThinkPad Laptop'),
 Text(0, 0, 'USB-C Charging Cable'),
 Text(0, 0, 'Vareebadd Phone'),
 Text(0, 0, 'Wired Headphones'),
 Text(0, 0, 'iPhone')]
```

<Figure size 2880x1728 with 0 Axes>



The top selling product is 'AAA Batteries'. The top selling products seem to have a correlation with the price of the product. The cheaper the product higher the quantity ordered and vice versa.

In [123]:
```python
all_data.shape
```

Out[123]: (197579, 10)

What products are most often sold together?

note: keep orders that have same order Id,are sold mostly together

In [169]:
```python
df=all_data[all_data['Order ID'].duplicated(keep=False)]
df.head(20)
```

Out[169]:

	Order ID	Product	Quantity Ordered	Price Each	Order Date	Purchase Address	Month	sales	city	Hour
3	176560	Google Phone	1	600.00	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001	4	600.00	Los Angeles	14
4	176560	Wired Headphones	1	11.99	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001	4	11.99	Los Angeles	14
18	176574	Google Phone	1	600.00	04/03/19 19:42	20 Hill St, Los Angeles, CA 90001	4	600.00	Los Angeles	19
19	176574	USB-C Charging Cable	1	11.95	04/03/19 19:42	20 Hill St, Los Angeles, CA 90001	4	11.95	Los Angeles	19
30	176585	Bose SoundSport Headphones	1	99.99	04/07/19 11:31	823 Highland St, Boston, MA 02215	4	99.99	Boston	11
31	176585	Bose SoundSport Headphones	1	99.99	04/07/19 11:31	823 Highland St, Boston, MA 02215	4	99.99	Boston	11
32	176586	AAA Batteries (4-pack)	2	2.99	04/10/19 17:00	365 Center St, San Francisco, CA 94016	4	5.98	San Francisco	17
33	176586	Google Phone	1	600.00	04/10/19 17:00	365 Center St, San Francisco, CA 94016	4	600.00	San Francisco	17
119	176672	Lightning Charging Cable	1	14.95	04/12/19 11:07	778 Maple St, New York City, NY 10001	4	14.95	New York City	11
120	176672	USB-C Charging Cable	1	11.95	04/12/19 11:07	778 Maple St, New York City, NY 10001	4	11.95	New York City	11
129	176681	Apple Airpods Headphones	1	150.00	04/20/19 10:39	331 Cherry St, Seattle, WA 98101	4	150.00	Seattle	10
130	176681	ThinkPad Laptop	1	999.99	04/20/19 10:39	331 Cherry St, Seattle, WA 98101	4	999.99	Seattle	10
138	176689	Bose SoundSport Headphones	1	99.99	04/24/19 17:15	659 Lincoln St, New York City, NY 10001	4	99.99	New York City	17
139	176689	AAA Batteries (4-pack)	2	2.99	04/24/19 17:15	659 Lincoln St, New York City, NY 10001	4	5.98	New York City	17
189	176739	34in Ultrawide Monitor	1	379.99	04/05/19 17:38	730 6th St, Austin, TX 73301	4	379.99	Austin	17
190	176739	Google Phone	1	600.00	04/05/19 17:38	730 6th St, Austin, TX 73301	4	600.00	Austin	17
225	176774	Lightning Charging Cable	1	14.95	04/25/19 15:06	372 Church St, Los Angeles, CA 90001	4	14.95	Los Angeles	15
226	176774	USB-C Charging Cable	1	11.95	04/25/19 15:06	372 Church St, Los Angeles, CA 90001	4	11.95	Los Angeles	15
233	176781	iPhone	1	700.00	04/03/19 07:37	976 Hickory St, Dallas, TX 75001	4	700.00	Dallas	7
234	176781	Lightning Charging Cable	1	14.95	04/03/19 07:37	976 Hickory St, Dallas, TX 75001	4	14.95	Dallas	7

In [171]:
```python
df.head()
```

Out[171]:

	Order ID	Product	Quantity Ordered	Price Each	Order Date	Purchase Address	Month	sales	city	Hour	Grouped
3	176560	Google Phone	1	600.00	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001	4	600.00	Los Angeles	14	Google Phone,Wired Headphones
4	176560	Wired Headphones	1	11.99	04/12/19 14:38	669 Spruce St, Los Angeles, CA 90001	4	11.99	Los Angeles	14	Google Phone,Wired Headphones
18	176574	Google Phone	1	600.00	04/03/19 19:42	20 Hill St, Los Angeles, CA 90001	4	600.00	Los Angeles	19	Google Phone,USB-C Charging Cable
19	176574	USB-C Charging Cable	1	11.95	04/03/19 19:42	20 Hill St, Los Angeles, CA 90001	4	11.95	Los Angeles	19	Google Phone,USB-C Charging Cable
30	176585	Bose SoundSport Headphones	1	99.99	04/07/19 11:31	823 Highland St, Boston, MA 02215	4	99.99	Boston	11	Bose SoundSport Headphones,Bose SoundSport Hea...

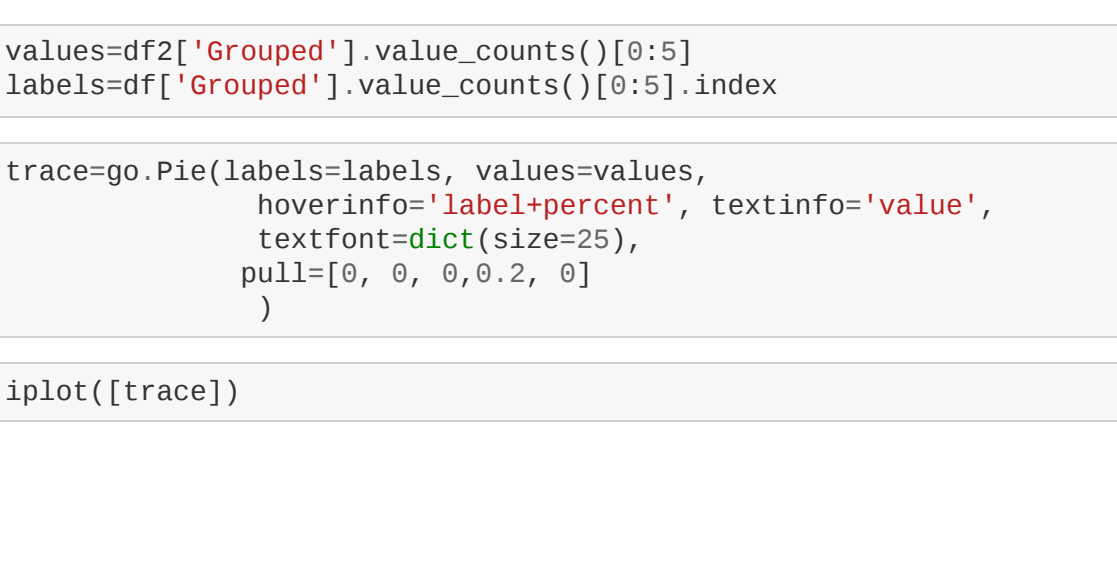
In [172]:
```python
df.shape
```

Out[172]: (14649, 11)

In [174]:
```python
#lets drop out all duplicate Order ID
df2 = df.drop_duplicates(subset=['Order ID'])
```

In [179]:
```python
df2['Grouped'].value_counts()[0:5].plot.pie()
```

Out[179]: <matplotlib.axes._subplots.AxesSubplot at 0xe60fac2c8>



In [180]:
```python
import plotly.graph_objs as go
from plotly.offline import iplot
```

In [185]:
```python
values=df2['Grouped'].value_counts()[0:5]
labels=df['Grouped'].value_counts()[0:5].index
```

In [186]:
```python
trace=go.Pie(labels=labels, values=values,
               hoverinfo='label+percent', textinfo='value',
               textfont=dict(size=25),
              pull=[0, 0, 0,0.2, 0]
               )
```

In [187]:
```python
iplot([trace])
```