```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt # visualizing data
%matplotlib inline

df = pd.read_csv( r'D:/data_analytics_project/Online Retail Data
set.csv', encoding= 'unicode_escape')

df

       InvoiceNo StockCode                          Description
Quantity  \
0         536365    85123A   WHITE HANGING HEART T-LIGHT HOLDER
6
1         536365     71053                  WHITE METAL LANTERN
6
2         536365    84406B       CREAM CUPID HEARTS COAT HANGER
8
3         536365    84029G  KNITTED UNION FLAG HOT WATER BOTTLE
6
4         536365    84029E       RED WOOLLY HOTTIE WHITE HEART.
6
...          ...       ...                                  ...
...
541904    581587     22613          PACK OF 20 SPACEBOY NAPKINS
12
541905    581587     22899         CHILDREN'S APRON DOLLY GIRL 
6
541906    581587     23254        CHILDRENS CUTLERY DOLLY GIRL 
4
541907    581587     23255      CHILDRENS CUTLERY CIRCUS PARADE
4
541908    581587     22138        BAKING SET 9 PIECE RETROSPOT 
3

             InvoiceDate  UnitPrice  CustomerID         Country
0       01-12-2010 08:26       2.55     17850.0  United Kingdom
1       01-12-2010 08:26       3.39     17850.0  United Kingdom
2       01-12-2010 08:26       2.75     17850.0  United Kingdom
3       01-12-2010 08:26       3.39     17850.0  United Kingdom
4       01-12-2010 08:26       3.39     17850.0  United Kingdom
...                  ...        ...         ...             ...
541904  09-12-2011 12:50       0.85     12680.0          France
541905  09-12-2011 12:50       2.10     12680.0          France
541906  09-12-2011 12:50       4.15     12680.0          France
541907  09-12-2011 12:50       4.15     12680.0          France
541908  09-12-2011 12:50       4.95     12680.0          France

[541909 rows x 8 columns]
```

```
df.shape
```

```
(541909, 8)
```

```
df['InvoiceDate'] = pd.to_datetime(df['InvoiceDate'], format='%d-%m-%Y
%H:%M')
```

```
df['InvoiceDate'].dtype
```

```
dtype('<M8[ns]')
```

```
print(df['InvoiceDate'].dtype)
```

```
datetime64[ns]
```

```
df.describe()
```

```
            Quantity                    InvoiceDate      UnitPrice  \
count  541909.000000                         541909  541909.000000   
mean        9.552250  2011-07-04 13:34:57.156386048       4.611114   
min    -80995.000000            2010-12-01 08:26:00  -11062.060000   
25%         1.000000            2011-03-28 11:34:00       1.250000   
50%         3.000000            2011-07-19 17:17:00       2.080000   
75%        10.000000            2011-10-19 11:27:00       4.130000   
max     80995.000000            2011-12-09 12:50:00   38970.000000   
std       218.081158                            NaN      96.759853   

          CustomerID  
count  406829.000000  
mean    15287.690570  
min     12346.000000  
25%     13953.000000  
50%     15152.000000  
75%     16791.000000  
max     18287.000000  
std      1713.600303  
```

```
extrem= df[(df['Quantity']==-80995.000000)|(df['Quantity']==
80995.000000)]
```

```
extrem # the dataset have extrem high values with opposite signs so it
was necessary to investigate
```

```
       InvoiceNo StockCode                   Description  Quantity  \
540421    581483     23843  PAPER CRAFT , LITTLE BIRDIE     80995   
540422   C581484     23843  PAPER CRAFT , LITTLE BIRDIE    -80995   

               InvoiceDate  UnitPrice  CustomerID         Country  
540421 2011-12-09 09:15:00       2.08     16446.0  United Kingdom  
540422 2011-12-09 09:27:00       2.08     16446.0  United Kingdom  
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 541909 entries, 0 to 541908
Data columns (total 8 columns):
 #   Column       Non-Null Count   Dtype
---  ------       --------------   -----
 0   InvoiceNo    541909 non-null  object
 1   StockCode    541909 non-null  object
 2   Description  540455 non-null  object
 3   Quantity     541909 non-null  int64
 4   InvoiceDate  541909 non-null  datetime64[ns]
 5   UnitPrice    541909 non-null  float64
 6   CustomerID   406829 non-null  float64
 7   Country      541909 non-null  object
dtypes: datetime64[ns](1), float64(2), int64(1), object(4)
memory usage: 33.1+ MB
```

```
df.isnull().sum()
```

```
InvoiceNo           0
StockCode           0
Description      1454
Quantity            0
InvoiceDate         0
UnitPrice           0
CustomerID     135080
Country             0
dtype: int64
```

```
#df['Description'].fillna('unknown',inplace= True)
df.fillna({'Description': 'unknown'}, inplace=True)
```

```
res= df[df['Description']=='unknown']
```

```
res
```

```
       InvoiceNo StockCode Description  Quantity
InvoiceDate  \
622       536414     22139     unknown        56 2010-12-01 11:52:00

1970      536545     21134     unknown         1 2010-12-01 14:32:00

1971      536546     22145     unknown         1 2010-12-01 14:33:00

1972      536547     37509     unknown         1 2010-12-01 14:33:00

1987      536549    85226A     unknown         1 2010-12-01 14:34:00

...          ...       ...         ...       ...                 ...

535322    581199     84581     unknown        -2 2011-12-07 18:26:00
```

```
535326    581203     23406     unknown        15 2011-12-07 18:31:00

535332    581209     21620     unknown         6 2011-12-07 18:35:00

536981    581234     72817     unknown        27 2011-12-08 10:33:00

538554    581408     85175     unknown        20 2011-12-08 14:06:00


        UnitPrice  CustomerID         Country
622           0.0         NaN  United Kingdom
1970          0.0         NaN  United Kingdom
1971          0.0         NaN  United Kingdom
1972          0.0         NaN  United Kingdom
1987          0.0         NaN  United Kingdom
...           ...         ...             ...
535322        0.0         NaN  United Kingdom
535326        0.0         NaN  United Kingdom
535332        0.0         NaN  United Kingdom
536981        0.0         NaN  United Kingdom
538554        0.0         NaN  United Kingdom

[1454 rows x 8 columns]
```

```
df.fillna({'CustomerID':-1}, inplace=True)

#res= df[df['Description']=='unknown']
#res  it is used to check that desired value is added in place of null
values in customerid col(it is more like code reusability)

df.head(4)
```

```
  InvoiceNo StockCode                          Description
Quantity  \
0    536365    85123A   WHITE HANGING HEART T-LIGHT HOLDER         6

1    536365     71053                  WHITE METAL LANTERN         6

2    536365    84406B       CREAM CUPID HEARTS COAT HANGER         8

3    536365    84029G  KNITTED UNION FLAG HOT WATER BOTTLE         6


          InvoiceDate  UnitPrice  CustomerID         Country
0 2010-12-01 08:26:00       2.55     17850.0  United Kingdom
1 2010-12-01 08:26:00       3.39     17850.0  United Kingdom
2 2010-12-01 08:26:00       2.75     17850.0  United Kingdom
3 2010-12-01 08:26:00       3.39     17850.0  United Kingdom
```

```
df.shape
```

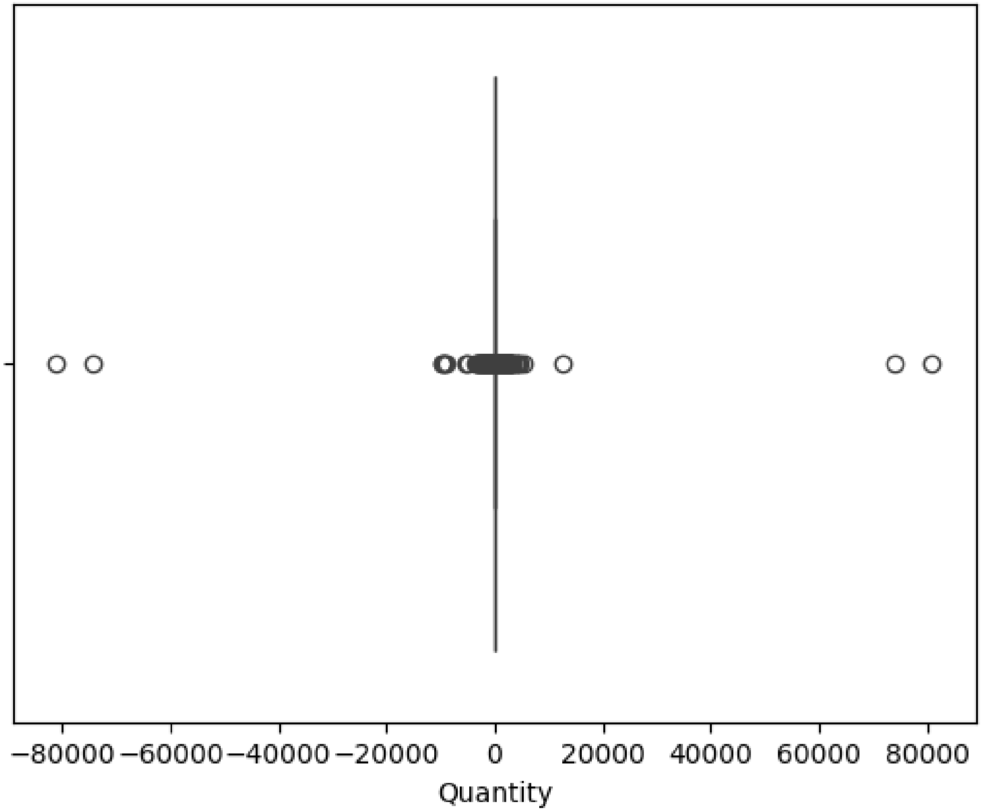
```
(541909, 8)
```

```
df.drop_duplicates(keep='first',inplace=True)
```

```
df.shape# it means this dataset has duplicates now after removing
dublicates it has this much rows 536641
```

```
(536641, 8)
```

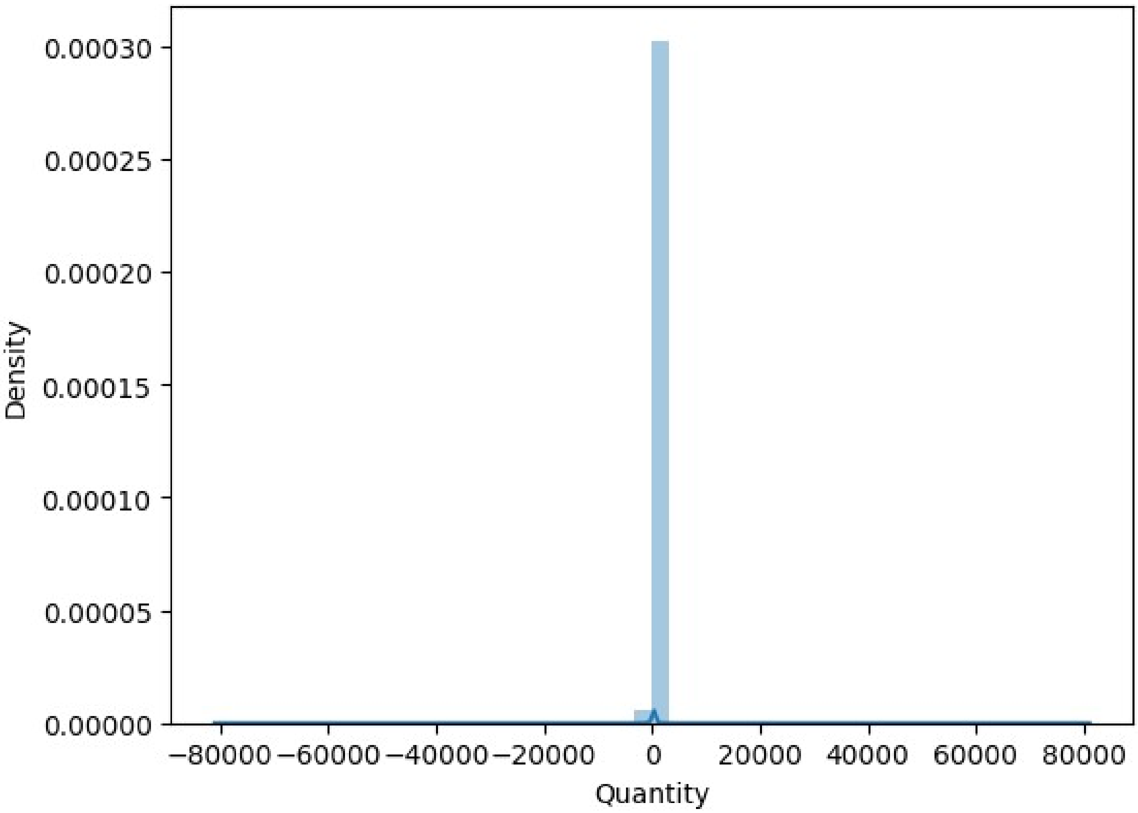
```
sns.boxplot(x="Quantity",data=df)
plt.show()
```



```
sns.distplot(df['Quantity'])
plt.show()
```

```
C:\Users\admin\AppData\Local\Temp\ipykernel_12420\3196584659.py:1:
UserWarning:

`distplot` is a deprecated function and will be removed in seaborn
v0.14.0.

Please adapt your code to use either `displot` (a figure-level
function with
similar flexibility) or `histplot` (an axes-level function for
histograms).
```

```
For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df['Quantity'])
```



```
df.describe()

            Quantity                    InvoiceDate      UnitPrice  \
count  536641.000000                         536641  536641.000000
mean        9.620029  2011-07-04 08:57:06.087421952       4.632656
min    -80995.000000            2010-12-01 08:26:00  -11062.060000
25%         1.000000            2011-03-28 10:52:00       1.250000
50%         3.000000            2011-07-19 14:04:00       2.080000
75%        10.000000            2011-10-18 17:05:00       4.130000
max     80995.000000            2011-12-09 12:50:00   38970.000000
std       219.130156                            NaN      97.233118

          CustomerID
count  536641.000000
mean    11435.653019
min        -1.000000
25%        -1.000000
50%     14336.000000
75%     16241.000000
```

```
max      18287.000000
std       6795.467745
```

```
Q1=1.000000
Q3=10.000000
IQR= Q3-Q1
```

```
min_range= Q1-(1.5*IQR)
max_range= Q3+(1.5*IQR)
min_range,max_range
```

```
(-12.5, 23.5)
```

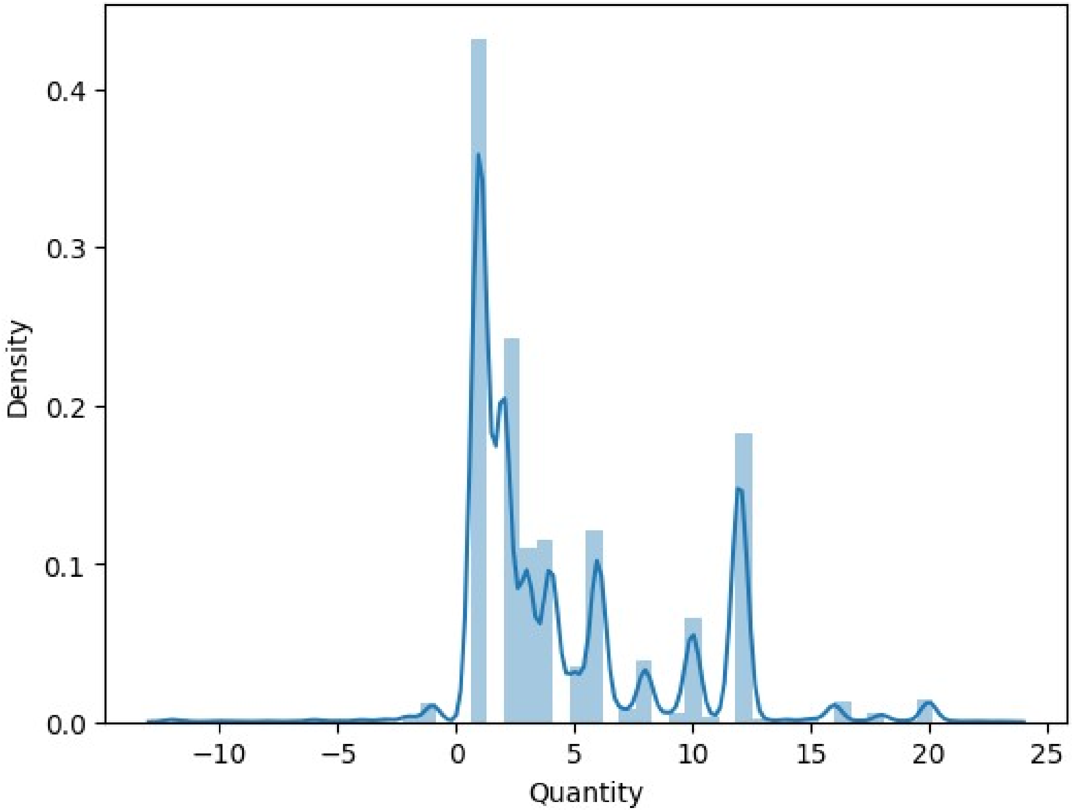
```
newdf= df[(df['Quantity']>min_range) & (df['Quantity']<max_range)]
#df[(df['Quantity'] >= lower_bound) & (df['Quantity'] <= upper_bound)]
```

```
newdf.shape
```

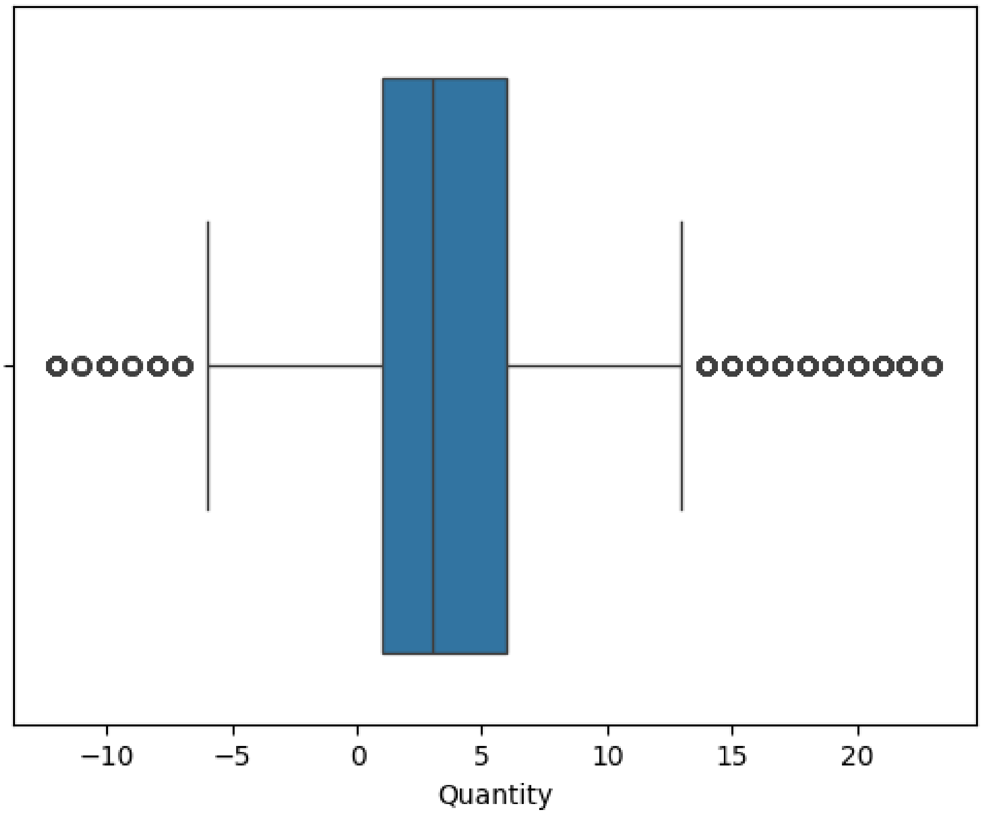
```
(478140, 8)
```

```
sns.distplot(newdf['Quantity'])
plt.show()
```

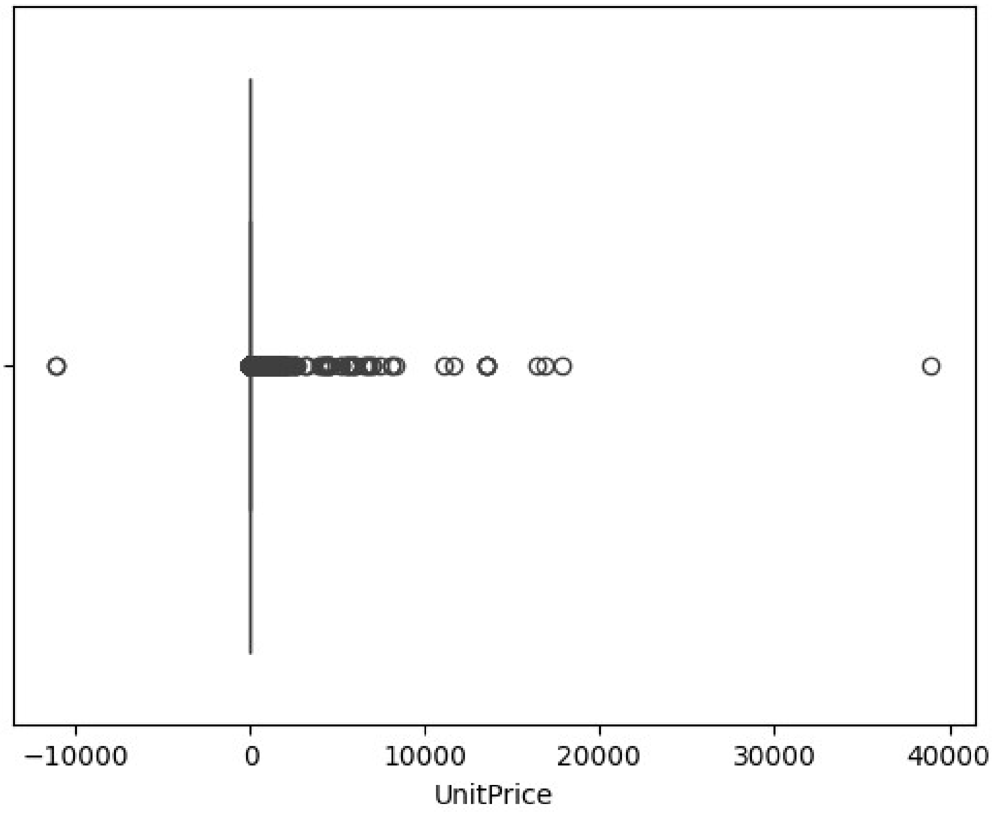
```
C:\Users\admin\AppData\Local\Temp\ipykernel_12420\2162961398.py:1:
UserWarning:

`distplot` is a deprecated function and will be removed in seaborn
v0.14.0.

Please adapt your code to use either `displot` (a figure-level
function with
similar flexibility) or `histplot` (an axes-level function for
histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(newdf['Quantity'])
```



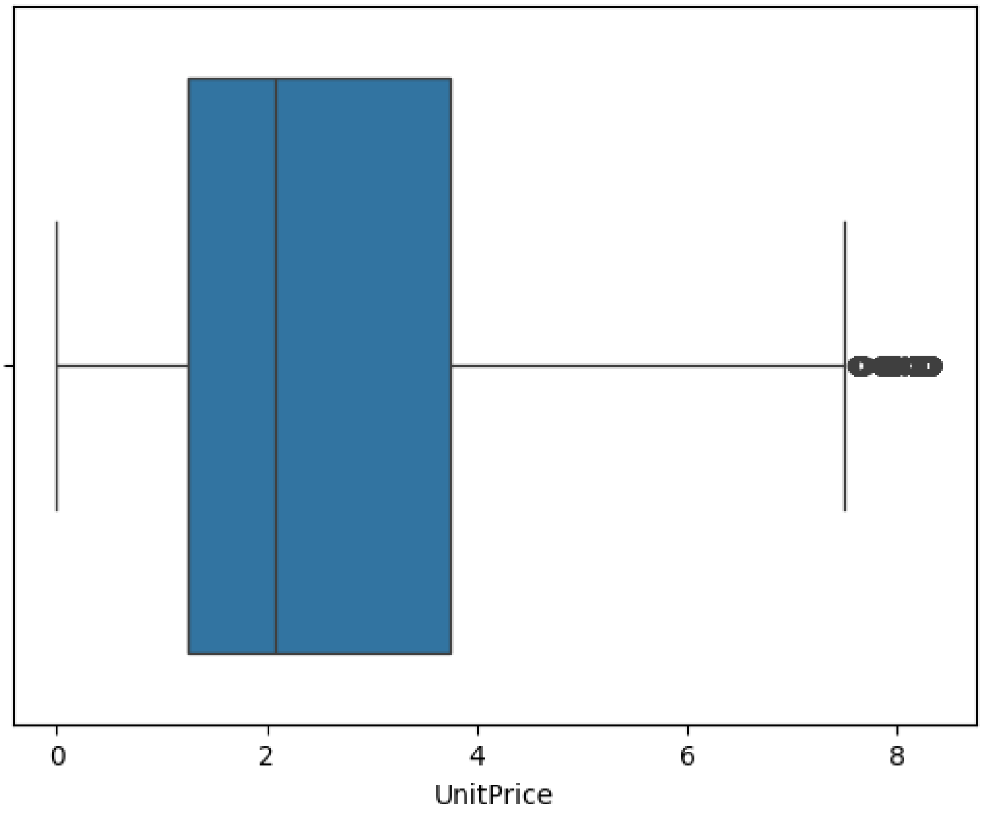
```
sns.boxplot(x="Quantity",data=newdf)
plt.show()
```



```
df.describe()

            Quantity                    InvoiceDate      UnitPrice  \
count  536641.000000                         536641  536641.000000
mean        9.620029  2011-07-04 08:57:06.087421952       4.632656
min    -80995.000000            2010-12-01 08:26:00  -11062.060000
25%         1.000000            2011-03-28 10:52:00       1.250000
50%         3.000000            2011-07-19 14:04:00       2.080000
75%        10.000000            2011-10-18 17:05:00       4.130000
max     80995.000000            2011-12-09 12:50:00   38970.000000
std       219.130156                            NaN      97.233118

          CustomerID
count  536641.000000
mean    11435.653019
min        -1.000000
25%        -1.000000
50%     14336.000000
75%     16241.000000
max     18287.000000
std      6795.467745

sns.boxplot(x="UnitPrice",data=newdf)
plt.show()
```



```
Q1=1.250000
Q3=4.130000
IQR=Q3-Q1

min_range= Q1-(1.5*IQR)
max_range= Q3+(1.5*IQR)
min_range,max_range

(-3.0700000000000003, 8.45)

newdff= newdf[(newdf['UnitPrice']>min_range) &
(newdf['UnitPrice']<max_range)]

newdff.shape

(439135, 8)

sns.boxplot(x="UnitPrice",data=newdff)
plt.show()
```



```
newdff.describe()

               Quantity                    InvoiceDate      UnitPrice  \
count     439135.000000                         439135  439135.000000
mean           4.833596  2011-07-05 12:03:17.051157504       2.700595
min          -12.000000            2010-12-01 08:26:00       0.000000
25%            1.000000            2011-03-28 14:23:00       1.250000
50%            3.000000            2011-07-20 15:44:00       2.080000
75%            8.000000            2011-10-20 11:51:00       3.750000
max           23.000000            2011-12-09 12:50:00       8.330000
std            4.624864                            NaN       1.932749

             CustomerID
count     439135.000000
mean       11266.083601
min           -1.000000
25%           -1.000000
50%        14367.000000
75%        16274.000000
max        18287.000000
std         6929.288537
```

```
Q1=1.000000
Q3=10.000000
IQR= Q3-Q1
```

```
min_range= Q1-(1.5*IQR)
max_range= Q3+(1.5*IQR)
min_range,max_range
```

```
(-12.5, 23.5)
```

```
outlierdf= df[(df['Quantity']<min_range) | (df['Quantity']>max_range)|
(df['UnitPrice']<min_range) | (df['UnitPrice']>max_range)] #|
(df['UnitPrice']<min_range) | (df['UnitPrice']>max_range)
```

```
outlierdf.shape
```

```
(61986, 8)
```

```
#common_rows= pd.merge(newdff,outlierdf,how='inner')
```

```
print("Unique rows in the outliers dataset:",outlierdf.shape[0])
print("Unique rows in the general dataset:",newdff.shape[0])
```

```
Unique rows in the outliers dataset: 61986
Unique rows in the general dataset: 439135
```

```
outlierdf.duplicated().sum()
```

```
np.int64(0)
```

```
newdff.duplicated().sum()
```

```
np.int64(0)
```

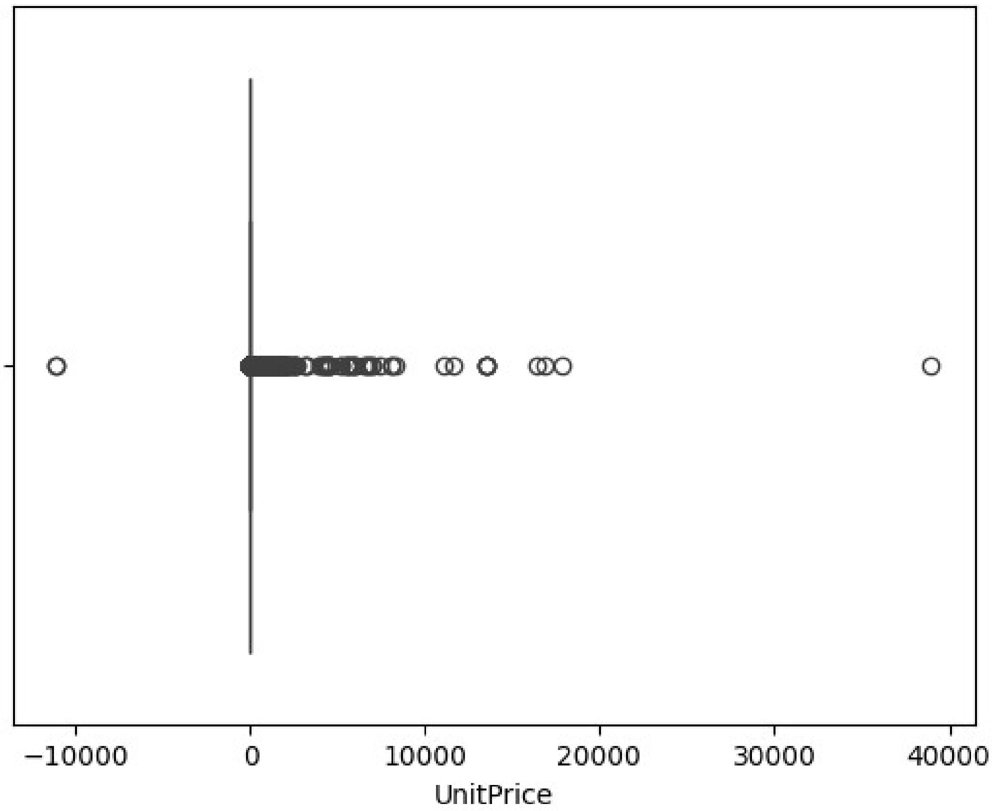
```
df.shape
```

```
(536641, 8)
```

```
outlierdf.head(100)
```

```
    InvoiceNo StockCode                          Description  Quantity
\
9      536367     84879        ASSORTED COLOUR BIRD ORNAMENT        32

26     536370     22728            ALARM CLOCK BAKELIKE PINK        24

27     536370     22727             ALARM CLOCK BAKELIKE RED        24

30     536370     21883                      STARS GIFT TAPE        24

31     536370     10002           INFLATABLE POLITICAL GLOBE        48

..        ...       ...                                  ...       ...

410    536404     21975        PACK OF 60 DINOSAUR CAKE CASES        24
```

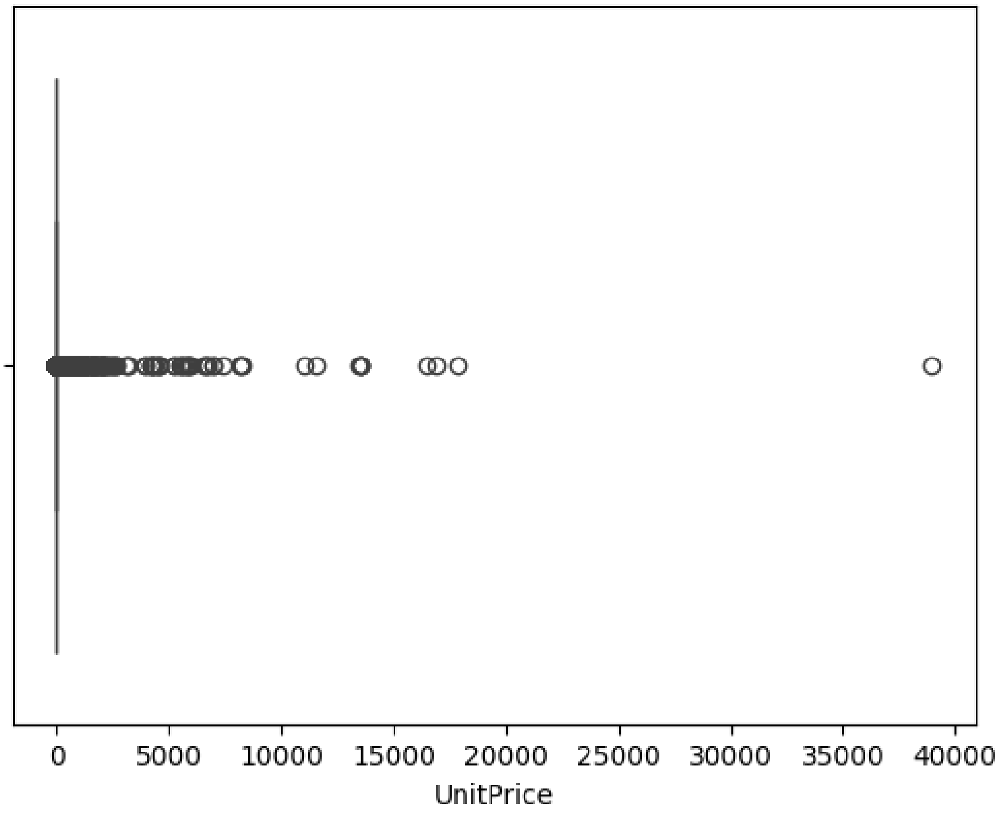
```
414    536404     22296            HEART IVORY TRELLIS LARGE        24

415    536405     20914  SET/5 RED RETROSPOT LID GLASS BOWLS       128

431    536406     22803             IVORY EMBROIDERED QUILT          2

435    536408     22537         MAGIC DRAWING SLATE DINOSAUR        24


            InvoiceDate  UnitPrice  CustomerID         Country
9   2010-12-01 08:34:00       1.69     13047.0  United Kingdom
26  2010-12-01 08:45:00       3.75     12583.0          France
27  2010-12-01 08:45:00       3.75     12583.0          France
30  2010-12-01 08:45:00       0.65     12583.0          France
31  2010-12-01 08:45:00       0.85     12583.0          France
..                  ...        ...         ...             ...
410 2010-12-01 11:29:00       0.55     16218.0  United Kingdom
414 2010-12-01 11:29:00       1.65     16218.0  United Kingdom
415 2010-12-01 11:32:00       2.55     14045.0  United Kingdom
431 2010-12-01 11:33:00      35.75     17850.0  United Kingdom
435 2010-12-01 11:41:00       0.42     14307.0  United Kingdom

[100 rows x 8 columns]

sns.boxplot(x='UnitPrice',data= outlierdf)
plt.show()
```



```
outlierdf= outlierdf[outlierdf['UnitPrice']>=0]

outlierdf.shape
```

```
(61984, 8)
```

```
sns.boxplot(x='UnitPrice',data= outlierdf)
plt.show()
```



```
#now we have two datasets one is for general insifhts 'newdff' and
another one is 'outlierdf' for outliers can include seasonalsale,vip
customer

newdff.head(4)

  InvoiceNo StockCode                          Description
Quantity  \
0    536365    85123A   WHITE HANGING HEART T-LIGHT HOLDER         6

1    536365     71053                  WHITE METAL LANTERN         6

2    536365    84406B       CREAM CUPID HEARTS COAT HANGER         8

3    536365    84029G  KNITTED UNION FLAG HOT WATER BOTTLE         6


          InvoiceDate  UnitPrice  CustomerID         Country
0 2010-12-01 08:26:00       2.55     17850.0  United Kingdom
1 2010-12-01 08:26:00       3.39     17850.0  United Kingdom
2 2010-12-01 08:26:00       2.75     17850.0  United Kingdom
3 2010-12-01 08:26:00       3.39     17850.0  United Kingdom

df['InvoiceDate'] = pd.to_datetime(df['InvoiceDate'], format= '%d-%m-
%Y  %H:%M')
```

```
print(newdff['Country'].shape)
```

```
(439135,)
```

```
newdff.head(1)
```

```
  InvoiceNo StockCode                          Description  Quantity  \
0    536365    85123A   WHITE HANGING HEART T-LIGHT HOLDER         6

          InvoiceDate  UnitPrice  CustomerID         Country
0 2010-12-01 08:26:00       2.55     17850.0  United Kingdom
```

```
print(newdff['CustomerID'].isnull().sum())
```

```
0
```

```
print(newdff['InvoiceNo'].isnull().sum())
```

```
0
```

```
# Reset the index if needed
newdff.reset_index(drop=True, inplace=True)
```

```
identified_cust= newdff[newdff['CustomerID']>-1]
```

```
uniden=newdff[newdff['CustomerID']==-1]
```

```
uniden['CustomerID']
```

```
1116     -1.0
1117     -1.0
1118     -1.0
1119     -1.0
1120     -1.0
         ...
438851   -1.0
438852   -1.0
438853   -1.0
438854   -1.0
438855   -1.0
Name: CustomerID, Length: 116575, dtype: float64
```

```
identified_cust['CustomerID'].count()
```

```
np.int64(322560)
```

```
identified_cust.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 322560 entries, 0 to 439134
Data columns (total 8 columns):
 #   Column       Non-Null Count   Dtype
---  ------       --------------   -----
```

```
 0   InvoiceNo    322560 non-null  object
 1   StockCode    322560 non-null  object
 2   Description  322560 non-null  object
 3   Quantity     322560 non-null  int64
 4   InvoiceDate  322560 non-null  datetime64[ns]
 5   UnitPrice    322560 non-null  float64
 6   CustomerID   322560 non-null  float64
 7   Country      322560 non-null  object
dtypes: datetime64[ns](1), float64(2), int64(1), object(4)
memory usage: 22.1+ MB
```

```
newdff.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 439135 entries, 0 to 439134
Data columns (total 8 columns):
 #   Column       Non-Null Count   Dtype
---  ------       --------------   -----
 0   InvoiceNo    439135 non-null  object
 1   StockCode    439135 non-null  object
 2   Description  439135 non-null  object
 3   Quantity     439135 non-null  int64
 4   InvoiceDate  439135 non-null  datetime64[ns]
 5   UnitPrice    439135 non-null  float64
 6   CustomerID   439135 non-null  float64
 7   Country      439135 non-null  object
dtypes: datetime64[ns](1), float64(2), int64(1), object(4)
memory usage: 26.8+ MB
```

```
newdff['Total_spending']=newdff['Quantity'] * newdff['UnitPrice']
customer_spending= newdff.groupby('CustomerID')
['Total_spending'].sum()
print(customer_spending)
```

```
CustomerID
-1.0        838188.95
 12347.0      2866.77
 12348.0        17.00
 12349.0      1155.75
 12350.0       274.00
              ...
 18280.0       160.70
 18281.0        46.92
 18282.0       111.68
 18283.0      2002.63
 18287.0       571.48
Name: Total_spending, Length: 4200, dtype: float64
```

```
C:\Users\admin\AppData\Local\Temp\ipykernel_12420\308204589.py:1:
SettingWithCopyWarning:
```

```
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  newdff['Total_spending']=newdff['Quantity'] * newdff['UnitPrice']
```

```
customer_order_da=  newdff.groupby('CustomerID').agg(
    total_order_value=('Total_spending', 'sum'),
    total_orders=('InvoiceNo', 'nunique')
)
customer_order_da.head(1)
```

```
            total_order_value  total_orders
CustomerID
-1.0                838188.95          2341
```

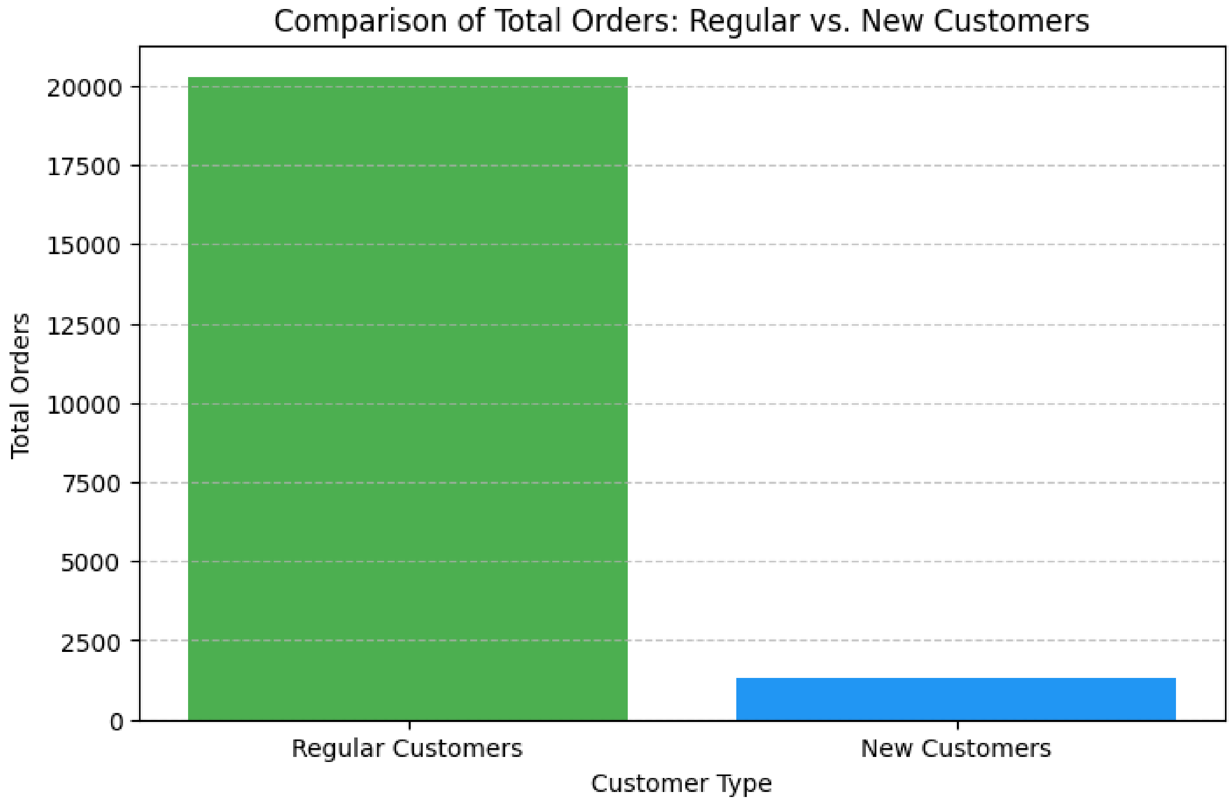
```
regular_customer= customer_order_da[customer_order_da['total_orders']
> 1]

regular_customer.head(1)
```

```
            total_order_value  total_orders
CustomerID
-1.0                838188.95          2341
```

```
regular_cust_df= regular_customer.reset_index()
regular_cust_df.head()
```

```
   CustomerID  total_order_value  total_orders
0        -1.0          838188.95          2341
1     12347.0            2866.77             7
2     12352.0            1027.11             8
3     12356.0             444.56             2
4     12358.0             456.36             2
```

```
# Step 1: Calculate total orders for each customer group
regular_total_orders = regular_cust_df['total_orders'].sum()
new_total_orders = new_cust['total_orders'].sum()

# Step 2: Create a DataFrame for visualization
order_data = {
    'Customer Type': ['Regular Customers', 'New Customers'],
    'Total Orders': [regular_total_orders, new_total_orders]
}
order_df = pd.DataFrame(order_data)

# Step 3: Plotting the bar chart
plt.figure(figsize=(8, 5))
plt.bar(order_df['Customer Type'], order_df['Total Orders'],
color=['#4caf50', '#2196f3'])
plt.xlabel('Customer Type')
plt.ylabel('Total Orders')
plt.title('Comparison of Total Orders: Regular vs. New Customers')
plt.xticks(rotation=0)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



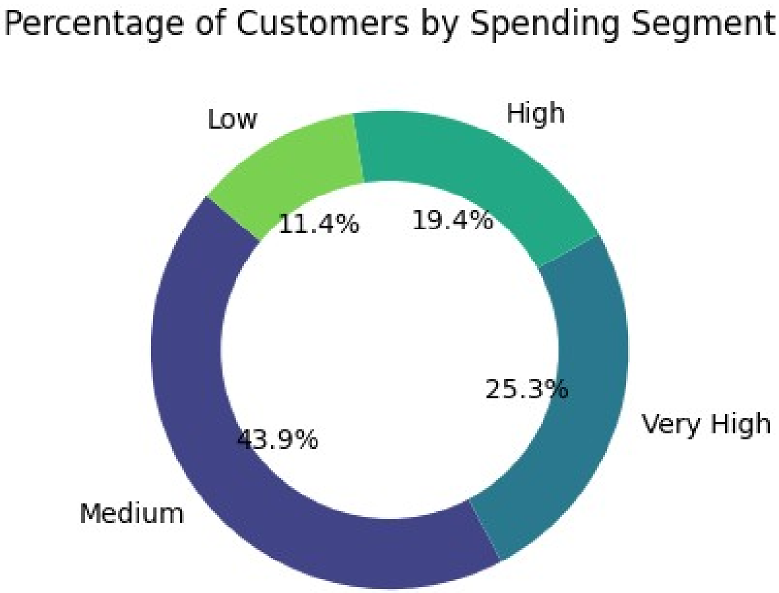
```
new_cust=customer_order_da[customer_order_da['total_orders'] == 1]

new_cust

            total_order_value  total_orders
CustomerID
12348.0                 17.00             1
12349.0               1155.75             1
12350.0                274.00             1
12353.0                 29.30             1
12354.0                651.55             1
...                       ...           ...
18262.0                117.32             1
18277.0                103.42             1
18278.0                173.90             1
```

```
18280.0                160.70            1
18281.0                 46.92            1

[1337 rows x 2 columns]
```

```python
customer_segments=pd.cut(customer_spending,
bins=[0,100,500,1000,float('inf')],labels=['Low','Medium','High','Very
High'])
print(customer_segments.value_counts())
```

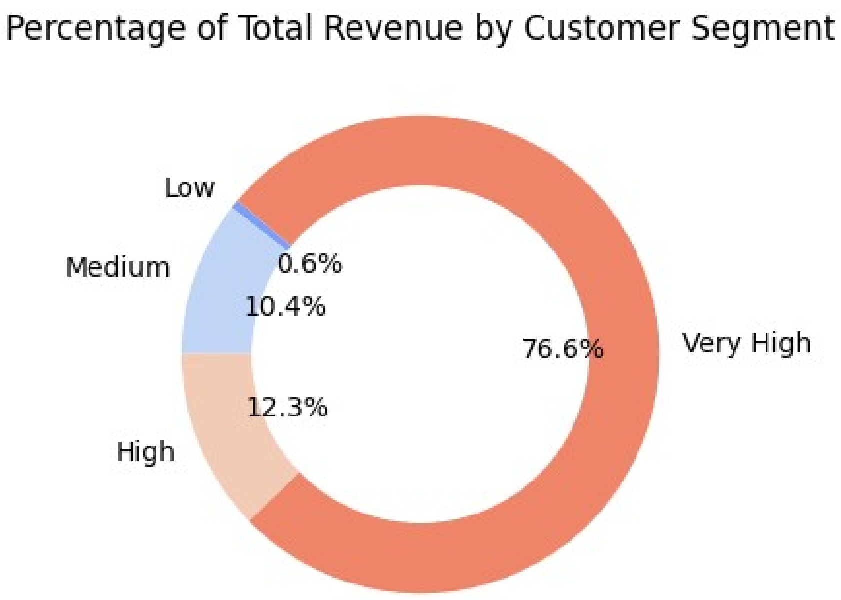
```
Total_spending
Medium       1822
Very High    1051
High          808
Low           474
Name: count, dtype: int64
```

```python
# percentage of cust for each segments medium 43%,very high 25%, high
19%,low 11%

# Count the number of customers in each segment
segment_counts = customer_segments.value_counts()

# Convert counts to percentages
segment_percentages = (segment_counts / segment_counts.sum()) * 100

# Plotting
plt.figure(figsize=(4, 4))
plt.pie(segment_percentages, labels=segment_percentages.index,
autopct='%1.1f%%', startangle=140, colors=sns.color_palette("viridis",
len(segment_percentages)))

# Draw a white circle at the center to create the donut shape
center_circle = plt.Circle((0, 0), 0.70, color='white')
plt.gca().add_artist(center_circle)

# Set title
plt.title('Percentage of Customers by Spending Segment')

# Display
plt.show()
```



```python
# Calculate revenue by segment
customer_spending_segmented =
customer_spending.groupby(customer_segments).sum()

# Convert revenue values to percentages
revenue_percentages = (customer_spending_segmented /
customer_spending_segmented.sum()) * 100

# Plotting the donut chart
plt.figure(figsize=(4, 4))
plt.pie(revenue_percentages, labels=revenue_percentages.index,
autopct='%1.1f%%', startangle=140,
colors=sns.color_palette('coolwarm', len(revenue_percentages)))

# Draw a white circle at the center to create the donut effect
center_circle = plt.Circle((0, 0), 0.70, color='white')
plt.gca().add_artist(center_circle)

# Set the title
plt.title('Percentage of Total Revenue by Customer Segment')
plt.show()
```

```
C:\Users\admin\AppData\Local\Temp\ipykernel_12420\3497106679.py:2:
FutureWarning: The default of observed=False is deprecated and will be
changed to True in a future version of pandas. Pass observed=False to
retain current behavior or observed=True to adopt the future default
and silence this warning.
  customer_spending_segmented =
customer_spending.groupby(customer_segments).sum()
```



```
# Group by month or year and calculate total sales
#newdff['MonthYear'] = newdff['InvoiceDate'].dt.to_period('M')''' .dt
is a special accessor in Pandas for datetime-like properties.
#It allows you to extract various components like the year, month,
day, hour, and so on.
#.dt.to_period('M'):

#The to_period('M') function converts the datetime values into a
period.
#By passing 'M', you are specifically telling Pandas to convert the
dates into monthly periods. So, it converts each date to just year and
month. '''
#monthly_sales = newdff.groupby('MonthYear')['Total_Spending'].sum()
#print(monthly_sales). # this is for explanation dont run this
script(warning)

newdff['monthyear']= newdff['InvoiceDate'].dt.to_period('M')
```

```
C:\Users\admin\AppData\Local\Temp\ipykernel_12420\1628629920.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  newdff['monthyear']= newdff['InvoiceDate'].dt.to_period('M')
```

```
newdff['monthyear'].dtype
```

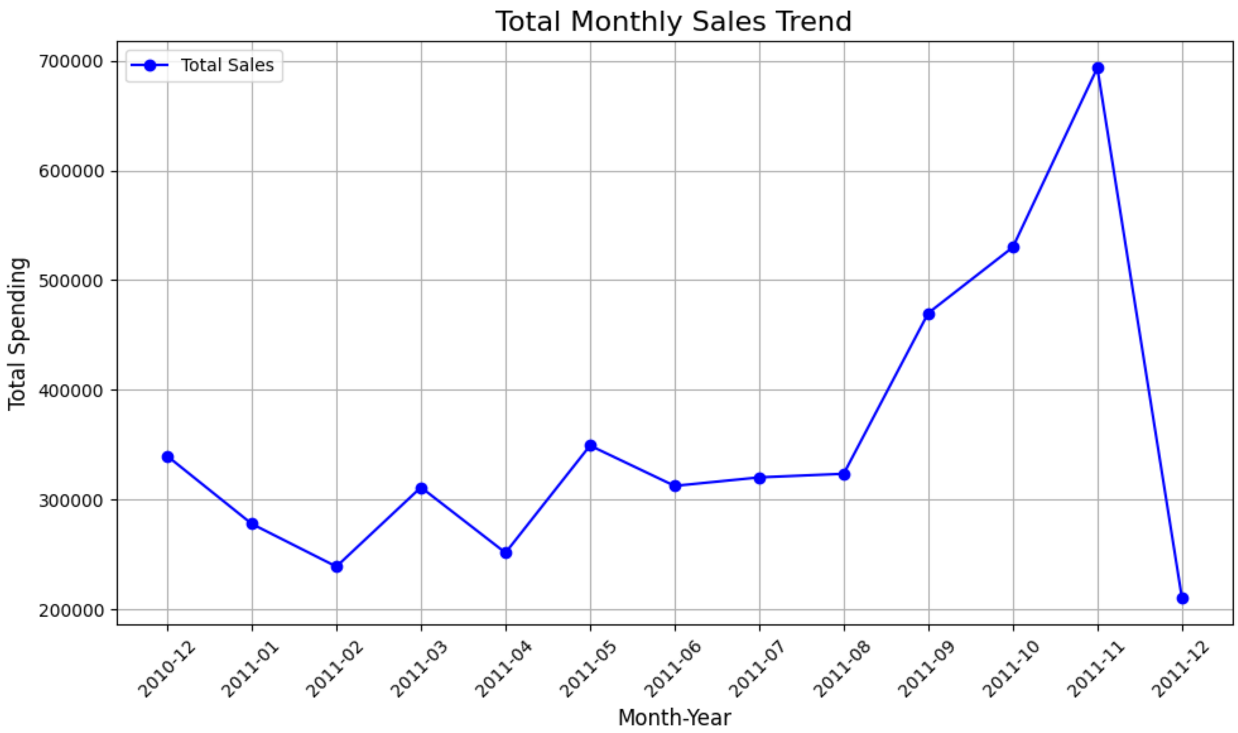
```
period[M]
```

```
monthly_sales=  newdff.groupby('monthyear')['Total_spending'].sum()
```

```
print(monthly_sales)
```

```
monthyear
2010-12    339813.740
2011-01    278049.740
2011-02    239189.210
2011-03    311367.920
2011-04    251771.221
2011-05    349407.510
2011-06    312682.920
2011-07    320420.671
2011-08    323714.060
2011-09    470042.982
2011-10    529987.160
2011-11    693366.340
2011-12    210863.330
Freq: M, Name: Total_spending, dtype: float64
```

```
plt.figure(figsize=(10, 6))

# Plot the line for monthly sales
plt.plot(monthly_sales.index.astype(str), monthly_sales.values,
marker='o', color='b', label='Total Sales')

# Add title and labels
plt.title('Total Monthly Sales Trend', fontsize=16)
plt.xlabel('Month-Year', fontsize=12)
plt.ylabel('Total Spending', fontsize=12)

# Rotate x-axis labels for better readability
plt.xticks(rotation=45)

# Add grid for better readability
plt.grid(True)

# Add a legend
plt.legend()

# Display the plot
plt.tight_layout()
plt.show()
```



```
newdff['yearly']= newdff['InvoiceDate'].dt.to_period('Y')
```

```
C:\Users\admin\AppData\Local\Temp\ipykernel_12420\3180027421.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  newdff['yearly']= newdff['InvoiceDate'].dt.to_period('Y')
```

```
Yearly_sales= newdff.groupby('yearly')['Total_spending'].sum()
```

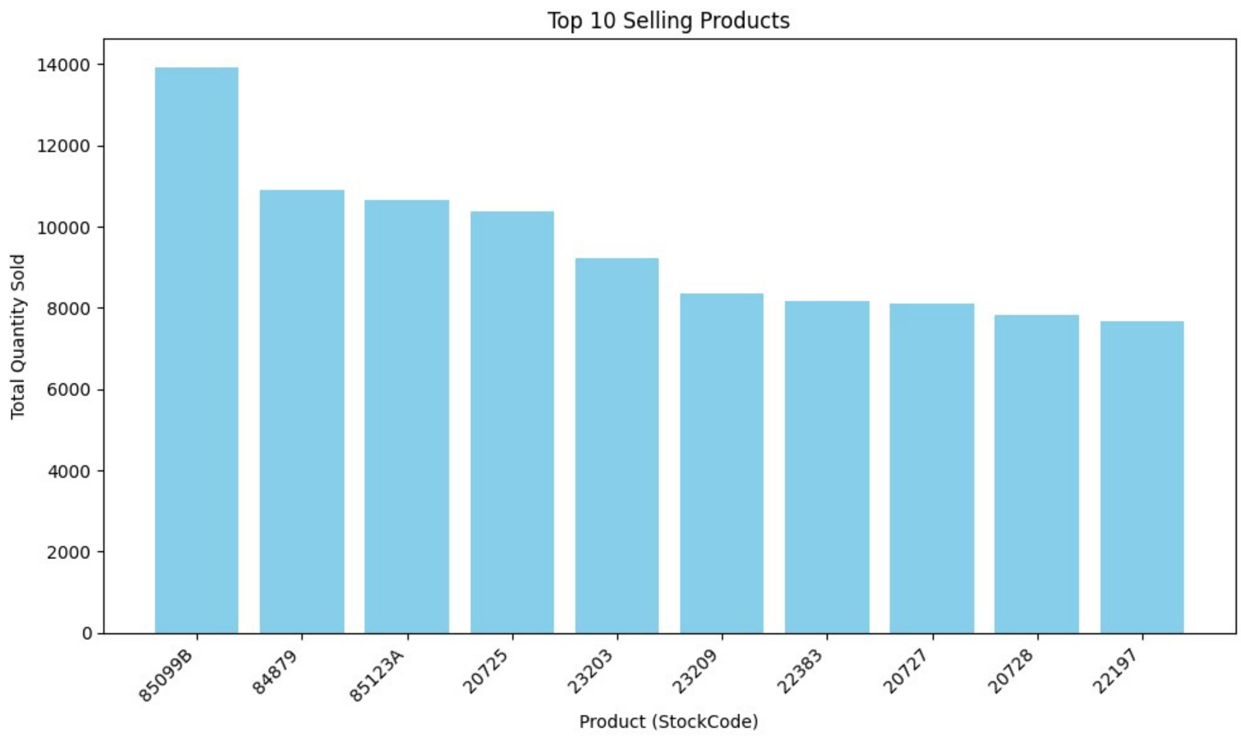
```
print(Yearly_sales)
```

```
yearly
2010     339813.740
2011    4290863.064
Freq: Y-DEC, Name: Total_spending, dtype: float64
```

```
newdff.head(2)
```

```
  InvoiceNo StockCode                         Description  Quantity  \
0    536365    85123A  WHITE HANGING HEART T-LIGHT HOLDER         6   
1    536365     71053                 WHITE METAL LANTERN         6   

          InvoiceDate  UnitPrice  CustomerID        Country
```

```
Total_spending  \
0 2010-12-01 08:26:00       2.55     17850.0  United Kingdom
15.30
1 2010-12-01 08:26:00       3.39     17850.0  United Kingdom
20.34

  monthyear yearly
0   2010-12   2010
1   2010-12   2010



# Assuming 'top_selling_products' is your DataFrame
top_selling_products = newdff.groupby('StockCode')
['Quantity'].sum().sort_values(ascending=False).reset_index()

# Get the top 10 selling products
top_10 = top_selling_products.head(10)

# Create a bar plot for the top 10 selling products
plt.figure(figsize=(10, 6))
plt.bar(top_10['StockCode'], top_10['Quantity'], color='skyblue')

# Add labels and title
plt.xlabel('Product (StockCode)')
plt.ylabel('Total Quantity Sold')
plt.title('Top 10 Selling Products')
plt.xticks(rotation=45, ha="right")  # Rotate x-axis labels for better
readability

# Show the plot
plt.tight_layout()
plt.show()
```



```
# Assuming 'StockCode' represents the product category
category_sales = newdff.groupby(['yearly', 'StockCode'])
['Quantity'].sum().reset_index()

# Sort to find the product category with the most sales for each year
category_sales_sorted = category_sales.sort_values(by=['yearly',
'Quantity'], ascending=[True, False])

print(category_sales_sorted)
```

```
      yearly StockCode  Quantity
2221    2010    85123A      1078
1567    2010     22961       916
847     2010     22086       904
1166    2010     22469       835
1524    2010     22910       751
...      ...       ...       ...
5521    2011    84750A       -13
5703    2011    85017A       -13
5593    2011    84872A       -15
6280    2011         S       -16
3030    2011     21361       -17

[6283 rows x 3 columns]
```

```
# revenue by country region
countrywise_sales= newdff.groupby('Country')
```

```
['Total_spending'].sum().sort_values(ascending=False)
print(countrywise_sales)

Country
United Kingdom          4084425.704
Germany                  120057.780
France                   105150.310
EIRE                      99910.620
Spain                     26390.270
Switzerland               25580.510
Belgium                   25337.810
Portugal                  18753.560
Norway                    14055.200
Netherlands               11711.420
Italy                     11479.180
Channel Islands           10636.330
Australia                 10120.370
Finland                    9428.750
Cyprus                     7002.980
Austria                    5767.190
Denmark                    5267.400
Singapore                  4261.080
Poland                     4182.920
Sweden                     4051.130
Hong Kong                  3925.890
Israel                     3433.440
Unspecified                3355.140
Greece                     2878.510
Iceland                    2866.770
Canada                     1670.600
Malta                      1325.880
United Arab Emirates       1061.980
Lithuania                  1027.100
Lebanon                     971.480
USA                         960.050
European Community          911.450
Japan                       854.930
RSA                         783.860
Brazil                      523.440
Bahrain                     218.300
Czech Republic              206.300
Saudi Arabia                131.170
Name: Total_spending, dtype: float64

import pandas as pd
import folium
from geopy.geocoders import Nominatim # geopy is used to get latitude
and longi of each country and nominatim is api which provide service
for requesting from server named OpenStreetMap server.
                                    # and this server returns lat and
```

```
log of each countries
# Assuming you already have the countrywise_sales data
countrywise_sales = newdff.groupby('Country')
['Total_spending'].sum().sort_values(ascending=False)

# Convert to a DataFrame
country_sales_df = countrywise_sales.reset_index()
country_sales_df.columns = ['Country', 'Total_Spending']

# Initialize Geolocator
geolocator = Nominatim(user_agent="geoapiExercisesbuddy")  # we are
creating object named geolocotor also creating different id to
identify us from server

# Function to get latitude and longitude
def get_lat_long(country):
    try:
        location = geolocator.geocode(country)
        return location.latitude, location.longitude
    except:
        return None, None

# Create new columns for Latitude and Longitude
country_sales_df['Latitude'] =
country_sales_df['Country'].apply(lambda x: get_lat_long(x)[0])
country_sales_df['Longitude'] =
country_sales_df['Country'].apply(lambda x: get_lat_long(x)[1])

# Remove rows with missing coordinates
country_sales_df.dropna(subset=['Latitude', 'Longitude'],
inplace=True)

# Initialize a Folium map centered around a global location
map_revenue = folium.Map(location=[20, 0], zoom_start=2)

# Add country markers to the map
for index, row in country_sales_df.iterrows(): # iterrows() gives
values of each countries like country name in index and pandas series(
o whole row of cols,revenue,coordinates)
    folium.CircleMarker(
        location=[row['Latitude'], row['Longitude']],# it is used to
access the values from row which we discussed above
        radius=row['Total_Spending'] / 1e6,  # Adjust radius for
visibility , here we are dividing from 100000
        color='blue',
        fill=True,
        fill_color='green',
        fill_opacity=0.6,
        popup=f"{row['Country']}: ${row['Total_Spending']:,.2f}"
    ).add_to(map_revenue)
```

```
# Show the map
map_revenue.save("Countrywise_Revenue_Map.html")
map_revenue

<folium.folium.Map at 0x1a7bb71c650>

 # now will remove some insights from outliers
# first will find top 5%  vip customers from our outliers

outlierdf['revenue']= outlierdf['Quantity']*outlierdf['UnitPrice']
outlierdf.head(1)

  InvoiceNo StockCode                    Description  Quantity  \
9    536367     84879  ASSORTED COLOUR BIRD ORNAMENT        32

          InvoiceDate  UnitPrice  CustomerID         Country  revenue

9 2010-12-01 08:34:00       1.69     13047.0  United Kingdom    54.08


# calculate total spending by each customer
customer_total_spendings= outlierdf.groupby('CustomerID')
['revenue'].sum()
print(customer_total_spendings)

CustomerID
-1.0        355747.54
 12346.0         0.00
 12347.0      1212.18
 12348.0      1780.24
 12349.0       471.35
              ...
 18274.0       -14.22
 18276.0        83.40
 18277.0         6.96
 18282.0        13.92
 18287.0      1231.80
Name: revenue, Length: 3619, dtype: float64

# now set the threshhold for top 5%
threshhold_value=customer_total_spendings.quantile(0.95)
print(threshhold_value)

2693.0039999999985

vip_customer=customer_total_spendings[customer_total_spendings>=thresh
hold_value]
nonvip_customer=customer_total_spendings[customer_total_spendings<thre
shhold_value]
print(vip_customer)
```

```
CustomerID
-1.0        355747.54
 12357.0      3316.66
 12409.0      9286.12
 12415.0    120176.11
 12433.0      7951.90
              ...
 18102.0    251917.33
 18139.0      7549.62
 18172.0      3946.24
 18198.0      3210.14
 18251.0      4314.72
Name: revenue, Length: 181, dtype: float64
```

```python
num_of_vip =vip_customer.count()
num_of_normal= nonvip_customer.count()
print(num_of_vip)
print(num_of_normal)
```

```
181
3438
```

```python
#During which months vips make the most purchases.
vipdf= outlierdf[outlierdf['CustomerID'].isin(vip_customer.index)]

vipdf.head(1)
```

```
   InvoiceNo StockCode                Description  Quantity  \
26    536370     22728  ALARM CLOCK BAKELIKE PINK        24

           InvoiceDate  UnitPrice  CustomerID Country  revenue
26 2010-12-01 08:45:00       3.75     12583.0  France     90.0
```

```python
vipdf['monthyear']= vipdf['InvoiceDate'].dt.to_period('M')
monthly_vip_sales= vipdf.groupby('monthyear')['revenue'].sum()
```

```
C:\Users\admin\AppData\Local\Temp\ipykernel_12420\1520124074.py:1: 
SettingWithCopyWarning: 
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: 
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  vipdf['monthyear']= vipdf['InvoiceDate'].dt.to_period('M')
```

```python
# Group by product categories and calculate total spending
product_sales = outlierdf.groupby('StockCode')
['revenue'].sum().sort_values(ascending=False)

print(product_sales.head(10))  # Top 10 product categories
```

```
StockCode
DOT        206065.97
22423       81185.95
85123A      65171.36
85099B      60121.77
23084       56985.79
47566       54800.20
22086       43569.68
22197       43011.28
22502       41670.00
84879       39765.11
Name: revenue, dtype: float64
```

```
outlierdf['monthyear']=outlierdf['InvoiceDate'].dt.to_period('M')

outlierdf.head(1)
```

```
  InvoiceNo StockCode                    Description  Quantity  \
9    536367     84879  ASSORTED COLOUR BIRD ORNAMENT        32

          InvoiceDate  UnitPrice  CustomerID         Country  revenue
\
9 2010-12-01 08:34:00       1.69     13047.0  United Kingdom    54.08


  monthyear
9   2010-12
```

```
monthly_outlier_sales= outlierdf.groupby('monthyear')['revenue'].sum()

monthly_outlier_sales.head(2)
```

```
monthyear
2010-12    316696.85
2011-01    222295.14
Freq: M, Name: revenue, dtype: float64
```

```
# Convert customer_segments Series to a DataFrame
customer_segments_df = customer_segments.reset_index()

# Rename columns for clarity
customer_segments_df.columns = ['CustomerID', 'Segment']

customer_spending_df= customer_spending.reset_index()
customer_spending_df.columns  =    ['CustomerID','Total_spending']
```

```python
# Combine customer spending DataFrame with customer segment DataFrame
combined_df = pd.merge(customer_spending_df, customer_segments_df,
on='CustomerID', how='left')
combined_df
```

```
      CustomerID  Total_spending    Segment
0           -1.0       838188.95  Very High
1        12347.0         2866.77  Very High
2        12348.0           17.00        Low
3        12349.0         1155.75  Very High
4        12350.0          274.00     Medium
...          ...             ...        ...
4195     18280.0          160.70     Medium
4196     18281.0           46.92        Low
4197     18282.0          111.68     Medium
4198     18283.0         2002.63  Very High
4199     18287.0          571.48       High

[4200 rows x 3 columns]
```

```python
# Extract relevant columns from newdff
date_df = newdff[['CustomerID', 'monthyear']]

# Merge with the combined DataFrame
final_df = pd.merge(combined_df, date_df, on='CustomerID', how='left')

final_df
```

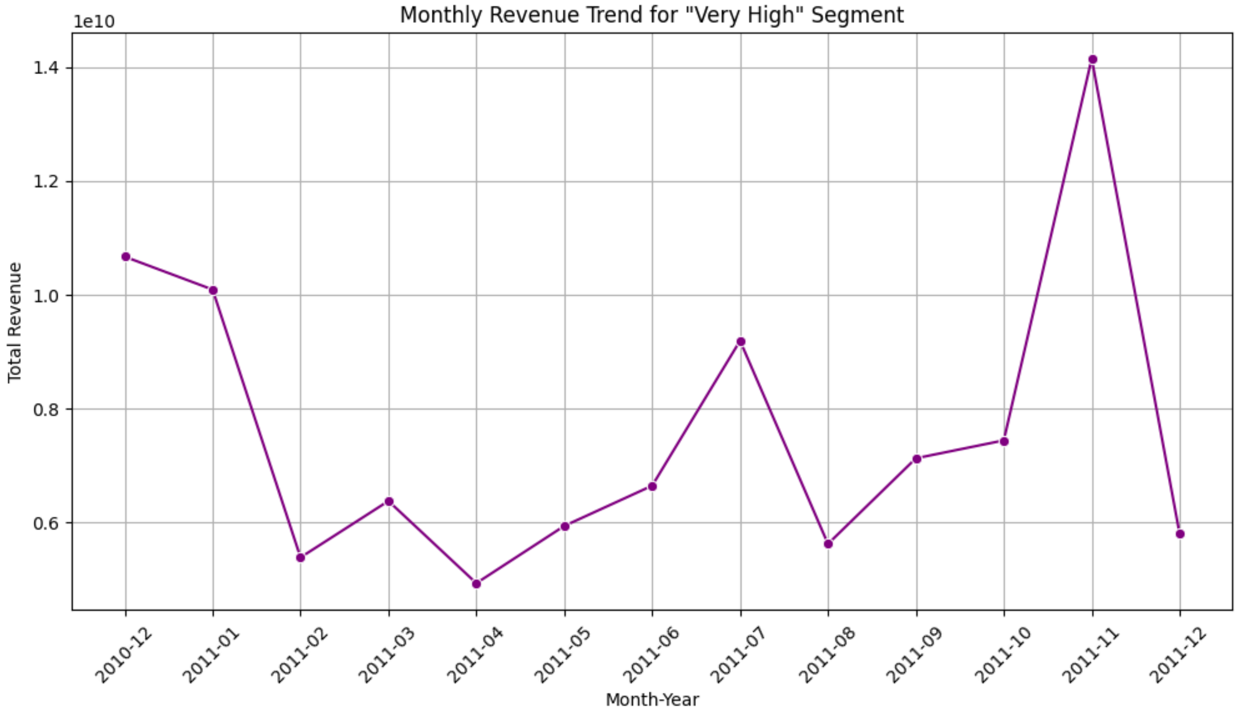
```
        CustomerID  Total_spending    Segment monthyear
0             -1.0       838188.95  Very High   2010-12
1             -1.0       838188.95  Very High   2010-12
2             -1.0       838188.95  Very High   2010-12
3             -1.0       838188.95  Very High   2010-12
4             -1.0       838188.95  Very High   2010-12
...            ...             ...        ...       ...
439130     18287.0          571.48       High   2011-10
439131     18287.0          571.48       High   2011-10
439132     18287.0          571.48       High   2011-10
439133     18287.0          571.48       High   2011-10
439134     18287.0          571.48       High   2011-10

[439135 rows x 4 columns]
```

```python
very_high_segment = final_df[final_df['Segment'] == 'Very High']
very_high_segment
```

```
        CustomerID  Total_spending    Segment monthyear
0             -1.0       838188.95  Very High   2010-12
1             -1.0       838188.95  Very High   2010-12
2             -1.0       838188.95  Very High   2010-12
3             -1.0       838188.95  Very High   2010-12
```

```
4              -1.0      838188.95  Very High   2010-12
...             ...            ...        ...       ...
439098      18283.0        2002.63  Very High   2011-12
439099      18283.0        2002.63  Very High   2011-12
439100      18283.0        2002.63  Very High   2011-12
439101      18283.0        2002.63  Very High   2011-12
439102      18283.0        2002.63  Very High   2011-12

[335161 rows x 4 columns]
```

```
trend_analysis = very_high_segment.groupby('monthyear')
['Total_spending'].sum().astype(int)

plt.figure(figsize=(12, 6))
sns.lineplot(x=trend_analysis.index.astype(str),
y=trend_analysis.values.astype(int), marker='o', color='purple')
plt.xticks(rotation=45)
plt.title('Monthly Revenue Trend for "Very High" Segment')
plt.xlabel('Month-Year')
plt.ylabel('Total Revenue')
plt.grid(True)
plt.show()
```



```
newdff.head(1)

  InvoiceNo StockCode                          Description  Quantity  \
0    536365    85123A   WHITE HANGING HEART T-LIGHT HOLDER         6
```

```
          InvoiceDate  UnitPrice  CustomerID         Country  
Total_spending  \
0 2010-12-01 08:26:00       2.55     17850.0  United Kingdom  
15.3   

  monthyear yearly  
0   2010-12   2010  
```

```
county_df = newdff[['CustomerID', 'Country']]

# Merge with the combined DataFrame
final_dff = pd.merge(combined_df, county_df, on='CustomerID',
how='left')

final_dff
```

```
        CustomerID  Total_spending    Segment         Country
0             -1.0       838188.95  Very High  United Kingdom
1             -1.0       838188.95  Very High  United Kingdom
2             -1.0       838188.95  Very High  United Kingdom
3             -1.0       838188.95  Very High  United Kingdom
4             -1.0       838188.95  Very High  United Kingdom
...            ...             ...        ...             ...
439130     18287.0          571.48       High  United Kingdom
439131     18287.0          571.48       High  United Kingdom
439132     18287.0          571.48       High  United Kingdom
439133     18287.0          571.48       High  United Kingdom
439134     18287.0          571.48       High  United Kingdom

[439135 rows x 4 columns]
```

```
customer_count_by_country = final_dff.groupby('Country')
['CustomerID'].nunique()
customer_count_by_country.sort_values(ascending=False)
```

```
Country
United Kingdom          3793
Germany                   93
France                    87
Spain                     29
Belgium                   25
Switzerland               22
Portugal                  20
Italy                     15
Finland                   12
Austria                   11
Norway                    10
Australia                  9
Sweden                     8
Denmark                    8
Cyprus                     7
```

```
Channel Islands            7
Netherlands                7
Poland                     5
Unspecified                5
Japan                      5
Greece                     4
USA                        4
EIRE                       4
Israel                     4
Canada                     3
Bahrain                    2
Malta                      2
United Arab Emirates       2
Brazil                     1
Czech Republic             1
Lebanon                    1
Iceland                    1
Hong Kong                  1
European Community         1
Saudi Arabia               1
RSA                        1
Lithuania                  1
Singapore                  1
Name: CustomerID, dtype: int64
```

```python
# Filter for very high segment customers (without specifying
countries)
high_value_customers = final_dff[final_dff['Segment'] == 'Very High']
# Group by country and count the number of unique customers in each
country
unique_customers_by_country = high_value_customers.groupby('Country')
['CustomerID'].nunique()

# Sort the result in descending order
sorted_customer_count_by_country =
unique_customers_by_country.sort_values(ascending=False)

print(sorted_customer_count_by_country)
```

```
Country
United Kingdom     918
Germany             35
France              27
Switzerland         11
Belgium             10
Portugal             7
Norway               6
Spain                6
Italy                5
Austria              4
```

```
Australia               4
EIRE                    4
Channel Islands         4
Finland                 3
Cyprus                  2
Poland                  2
Denmark                 2
Israel                  2
Netherlands             2
Canada                  1
Greece                  1
Hong Kong               1
Iceland                 1
Lithuania               1
Singapore               1
Sweden                  1
Unspecified             1
Name: CustomerID, dtype: int64
```

```
regul_highvalue_cust=
pd.merge(final_dff,regular_cust_df ,on='CustomerID',how='right')
```

```
regul_highvalue_cust.head(2)
```

```
   CustomerID  Total_spending    Segment         Country
total_order_value  \
0        -1.0       838188.95  Very High  United Kingdom
838188.95
1        -1.0       838188.95  Very High  United Kingdom
838188.95

   total_orders
0          2341
1          2341
```

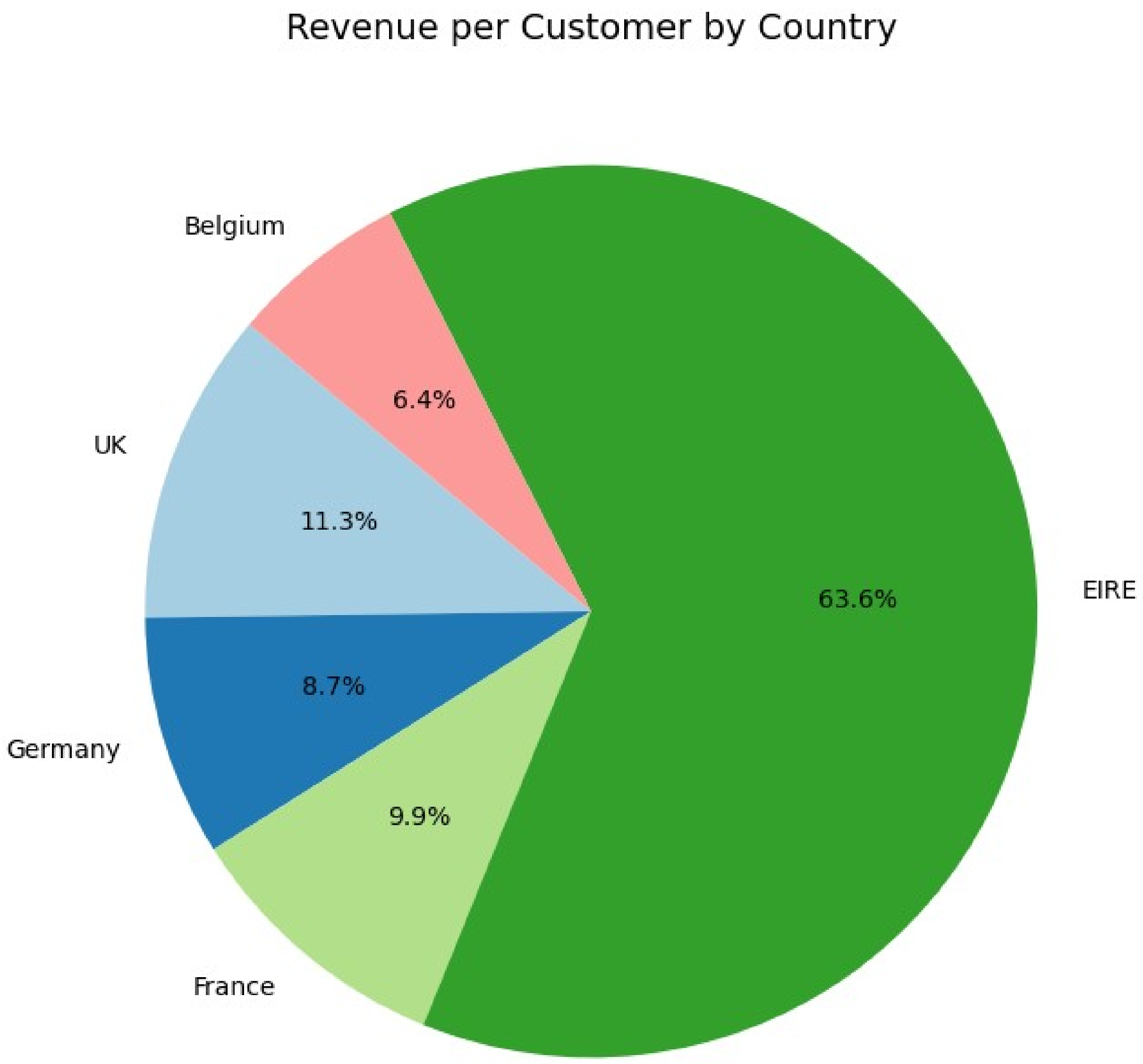
```
# countries with high value and reg customers
highvaluecust= regul_highvalue_cust[regul_highvalue_cust['Segment'] ==
'Very High']
specialcust=  highvaluecust.groupby('Country')['CustomerID'].nunique()
specialcust= specialcust.sort_values(ascending=False)
```

```
specialcust
```

```
Country
United Kingdom     917
Germany             35
France              27
Belgium             10
Switzerland          8
Portugal             7
Norway               6
```

```
Spain                   6
Austria                 4
Australia               4
Channel Islands         4
EIRE                    4
Italy                   4
Denmark                 2
Poland                  2
Finland                 2
Cyprus                  2
Netherlands             2
Canada                  1
Hong Kong               1
Iceland                 1
Israel                  1
Lithuania               1
Singapore               1
Sweden                  1
Unspecified             1
Name: CustomerID, dtype: int64
```

```python
import pandas as pd
import matplotlib.pyplot as plt

# Data
countries = ['UK', 'Germany', 'France', 'EIRE', 'Belgium']
revenues = [4084425, 120057, 105150, 99910, 25337]
customers = [917, 35, 27, 4, 10]

# Create a DataFrame
data = pd.DataFrame({
    'Country': countries,
    'Revenue': revenues,
    'Customers': customers
})

# Calculate Revenue per Customer
data['Revenue per Customer'] = data['Revenue'] / data['Customers']

# Plotting the pie chart
plt.figure(figsize=(8, 8))
plt.pie(data['Revenue per Customer'], labels=data['Country'],
autopct='%1.1f%%', startangle=140, colors=plt.cm.Paired.colors)

# Add title
plt.title('Revenue per Customer by Country', fontsize=14)

# Display the pie chart
plt.show()
```



```
highvaluecust = highvaluecust.join(newdff['StockCode'], how='left')

highvaluecust.head(1)

   CustomerID  Total_spending    Segment         Country
total_order_value  \
0        -1.0       838188.95  Very High  United Kingdom
838188.95

   total_orders StockCode
0          2341    85123A
```

```
Topcust_buying_category=
highvaluecust.groupby(['CustomerID','StockCode','Country'])
['total_orders'].sum()
```