In [50]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [25]:
```
File = "C:\\Users\\hitak\\Downloads\\OnlineRetail.xlsx"
df =pd.read_excel(File)
df
```

Out[25]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Cou
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	2010-12-01 08:26:00	2.55	17850.0	Ur King
1	536365	71053	WHITE METAL LANTERN	6	2010-12-01 08:26:00	3.39	17850.0	Ur King
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	2010-12-01 08:26:00	2.75	17850.0	Ur King
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	2010-12-01 08:26:00	3.39	17850.0	Ur King
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	2010-12-01 08:26:00	3.39	17850.0	Ur King
...	...	...	...	...	...	...	...	
541904	581587	22613	PACK OF 20 SPACEBOY NAPKINS	12	2011-12-09 12:50:00	0.85	12680.0	Fra
541905	581587	22899	CHILDREN'S APRON DOLLY GIRL	6	2011-12-09 12:50:00	2.10	12680.0	Fra
541906	581587	23254	CHILDRENS CUTLERY DOLLY GIRL	4	2011-12-09 12:50:00	4.15	12680.0	Fra
541907	581587	23255	CHILDRENS CUTLERY CIRCUS PARADE	4	2011-12-09 12:50:00	4.15	12680.0	Fra
541908	581587	22138	BAKING SET 9 PIECE RETROSPOT	3	2011-12-09 12:50:00	4.95	12680.0	Fra

541909 rows × 8 columns

In [26]:
```
df.head()
```

Out[26]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	2010-12-01 08:26:00	2.55	17850.0	United Kingdom
1	536365	71053	WHITE METAL LANTERN	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom

In [26]:
```
1 df.head()
```

Out[26]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	2010-12-01 08:26:00	2.55	17850.0	United Kingdom
1	536365	71053	WHITE METAL LANTERN	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	2010-12-01 08:26:00	2.75	17850.0	United Kingdom
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom

In [27]:
```
1 df.tail()
```

Out[27]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Cou
541904	581587	22613	PACK OF 20 SPACEBOY NAPKINS	12	2011-12-09 12:50:00	0.85	12680.0	Fra
541905	581587	22899	CHILDREN'S APRON DOLLY GIRL	6	2011-12-09 12:50:00	2.10	12680.0	Fra
541906	581587	23254	CHILDRENS CUTLERY DOLLY GIRL	4	2011-12-09 12:50:00	4.15	12680.0	Fra
541907	581587	23255	CHILDRENS CUTLERY CIRCUS PARADE	4	2011-12-09 12:50:00	4.15	12680.0	Fra
541908	581587	22138	BAKING SET 9 PIECE RETROSPOT	3	2011-12-09 12:50:00	4.95	12680.0	Fra

In [28]:
```
1 df.shape
```

Out[28]: (541909, 8)

In [29]:
```
1 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
```

In [29]:
```
1 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
```

In [30]:
```
1 df.describe()
```

Out[30]:

	Quantity	UnitPrice	CustomerID
count	541909.000000	541909.000000	406829.000000
mean	9.552250	4.611114	15287.690570
std	218.081158	96.759853	1713.600303
min	-80995.000000	-11062.060000	12346.000000
25%	1.000000	1.250000	13953.000000
50%	3.000000	2.080000	15152.000000
75%	10.000000	4.130000	16791.000000
max	80995.000000	38970.000000	18287.000000

In [31]:
```
1 df.duplicated().sum()
```

Out[31]: 5268

In [32]:
```
1 df[df.duplicated()]
```

Out[32]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	C
517	536409	21866	UNION JACK FLAG LUGGAGE TAG	1	2010-12-01 11:45:00	1.25	17908.0	K
527	536409	22866	HAND WARMER SCOTTY DOG DESIGN	1	2010-12-01 11:45:00	2.10	17908.0	K
537	536409	22900	SET 2 TEA TOWELS I LOVE LONDON	1	2010-12-01 11:45:00	2.95	17908.0	K
539	536409	22111	SCOTTIE DOG HOT WATER	1	2010-12-01 11:45:00	4.95	17908.0	K

In [33]:
```
1 df.isnull().sum()
```

Out[33]:
```
InvoiceNo          0
StockCode          0
Description     1454
Quantity           0
InvoiceDate        0
UnitPrice          0
CustomerID     135080
Country            0
dtype: int64
```

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

Out[33]:

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

In [41]:

```
1 df["Description"].fillna("No Description", inplace=True)
2 df["CustomerID"].fillna(-1, inplace=True)
3 df
```

Out[41]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Cou
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	2010-12-01 08:26:00	2.55	17850.0	Ur King
1	536365	71053	WHITE METAL LANTERN	6	2010-12-01 08:26:00	3.39	17850.0	Ur King
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	2010-12-01 08:26:00	2.75	17850.0	Ur King
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	2010-12-01 08:26:00	3.39	17850.0	Ur King
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	2010-12-01 08:26:00	3.39	17850.0	Ur King
...	...	...	...	...	...	...	...	
541904	581587	22613	PACK OF 20 SPACEBOY NAPKINS	12	2011-12-09 12:50:00	0.85	12680.0	Fra
541905	581587	22899	CHILDREN'S APRON DOLLY GIRL	6	2011-12-09 12:50:00	2.10	12680.0	Fra
541906	581587	23254	CHILDRENS CUTLERY DOLLY GIRL	4	2011-12-09 12:50:00	4.15	12680.0	Fra
541907	581587	23255	CHILDRENS CUTLERY CIRCUS PARADE	4	2011-12-09 12:50:00	4.15	12680.0	Fra
541908	581587	22138	BAKING SET 9 PIECE RETROSPOT	3	2011-12-09 12:50:00	4.95	12680.0	Fra

541909 rows × 8 columns

In [43]:

```
1 df.info
```

Out[42]:

```
<bound method DataFrame.info of        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
```

Out[42]:

```
Index(['InvoiceNo', 'StockCode', 'Description', 'Quantity', 'InvoiceDate',
       'UnitPrice', 'CustomerID', 'Country'],
      dtype='object')
```

In [43]:
```
df.info
```

Out[43]:
```
<bound method DataFrame.info of        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      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
4      2010-12-01 08:26:00       3.39     17850.0  United Kingdom
...                    ...        ...         ...             ...
541904 2011-12-09 12:50:00       0.85     12680.0          France
541905 2011-12-09 12:50:00       2.10     12680.0          France
541906 2011-12-09 12:50:00       4.15     12680.0          France
541907 2011-12-09 12:50:00       4.15     12680.0          France
541908 2011-12-09 12:50:00       4.95     12680.0          France

[541909 rows x 8 columns]>
```

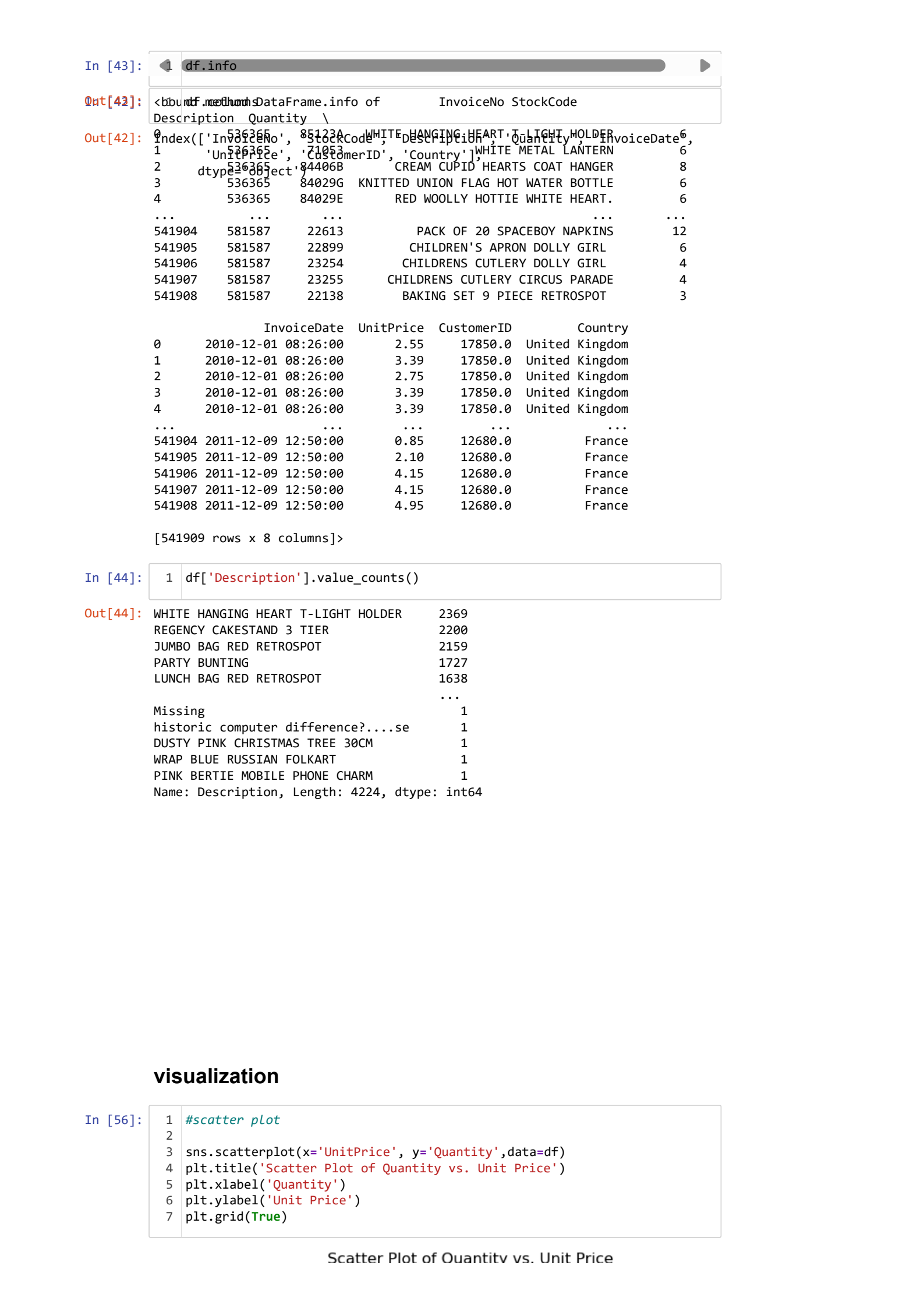
Out[42]:
```
Index(['InvoiceNo', 'StockCode', 'Description', 'Quantity', 'InvoiceDate',
       'UnitPrice', 'CustomerID', 'Country'],
      dtype='object')
```

In [44]:
```
df['Description'].value_counts()
```

Out[44]:
```
WHITE HANGING HEART T-LIGHT HOLDER     2369
REGENCY CAKESTAND 3 TIER               2200
JUMBO BAG RED RETROSPOT                2159
PARTY BUNTING                          1727
LUNCH BAG RED RETROSPOT                1638
                                       ...
Missing                                   1
historic computer difference?....se       1
DUSTY PINK CHRISTMAS TREE 30CM            1
WRAP BLUE RUSSIAN FOLKART                 1
PINK BERTIE MOBILE PHONE CHARM            1
Name: Description, Length: 4224, dtype: int64
```

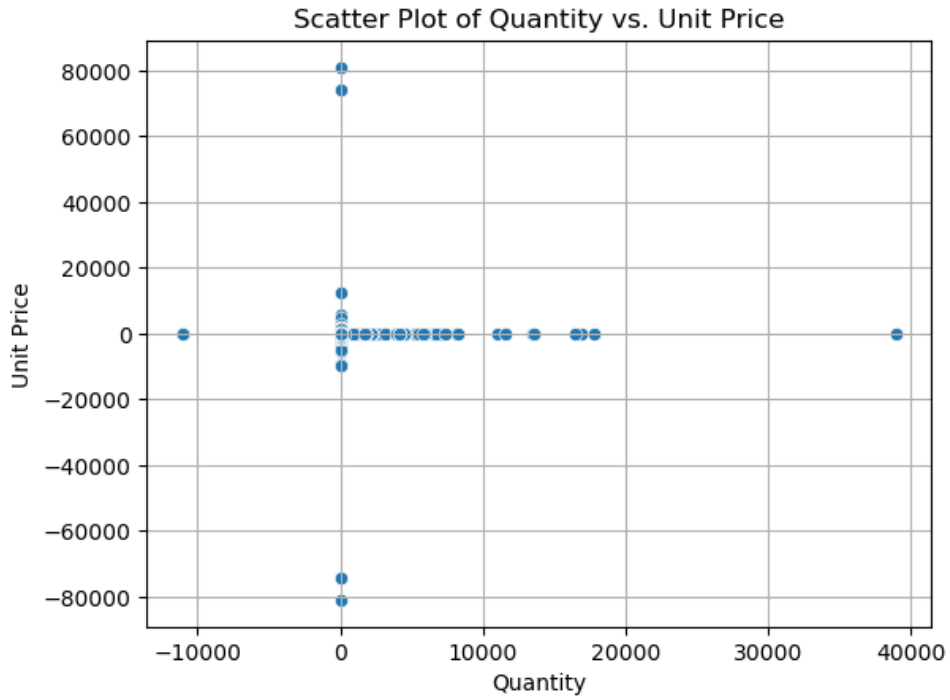
visualization

In [56]:
```
#scatter plot

sns.scatterplot(x='UnitPrice', y='Quantity',data=df)
plt.title('Scatter Plot of Quantity vs. Unit Price')
plt.xlabel('Quantity')
plt.ylabel('Unit Price')
plt.grid(True)
```



visualization

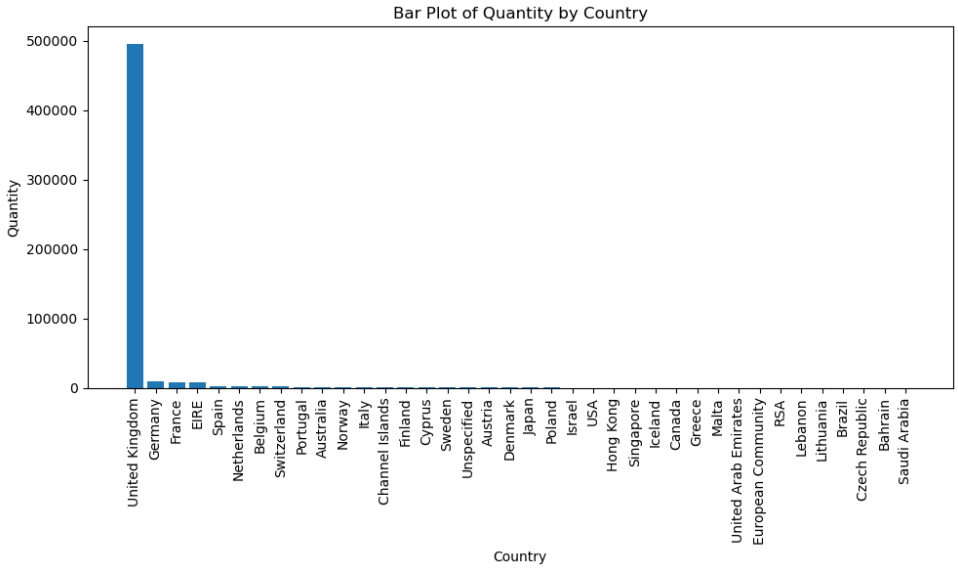
In [56]:
```
#scatter plot

sns.scatterplot(x='UnitPrice', y='Quantity',data=df)
plt.title('Scatter Plot of Quantity vs. Unit Price')
plt.xlabel('Quantity')
plt.ylabel('Unit Price')
plt.grid(True)
```



In [58]:
```
#Barplot

country_counts = df['Country'].value_counts()
countries = country_counts.index
quantity_values = country_counts.values

plt.figure(figsize=(10, 6))
plt.bar(countries, quantity_values)
plt.title('Bar Plot of Quantity by Country')
plt.xlabel('Country')
plt.ylabel('Quantity')
plt.xticks(rotation=90)
plt.tight_layout()
```

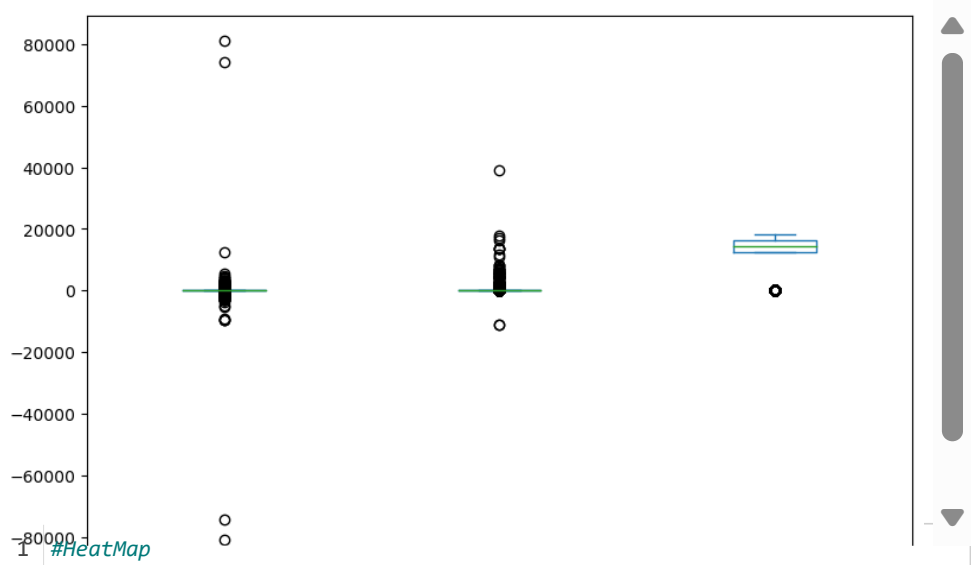
In [58]:

```
#Barplot

country_counts = df['Country'].value_counts()
countries = country_counts.index
quantity_values = country_counts.values

plt.figure(figsize=(10, 6))
plt.bar(countries, quantity_values)
plt.title('Bar Plot of Quantity by Country')
plt.xlabel('Country')
plt.ylabel('Quantity')
plt.xticks(rotation=90)
plt.tight_layout()
plt.show()

```



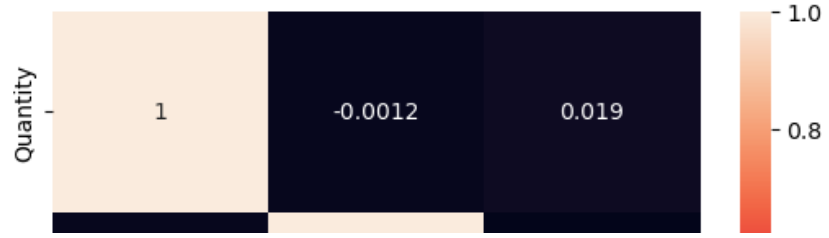
In [52]:

```
#box plot for outlier detection
df.plot(kind='box', figsize=(9,6))
plt.show()
```



In [53]:

```
#HeatMap
sns.heatmap(df.corr(),annot=True)
plt.show()
```



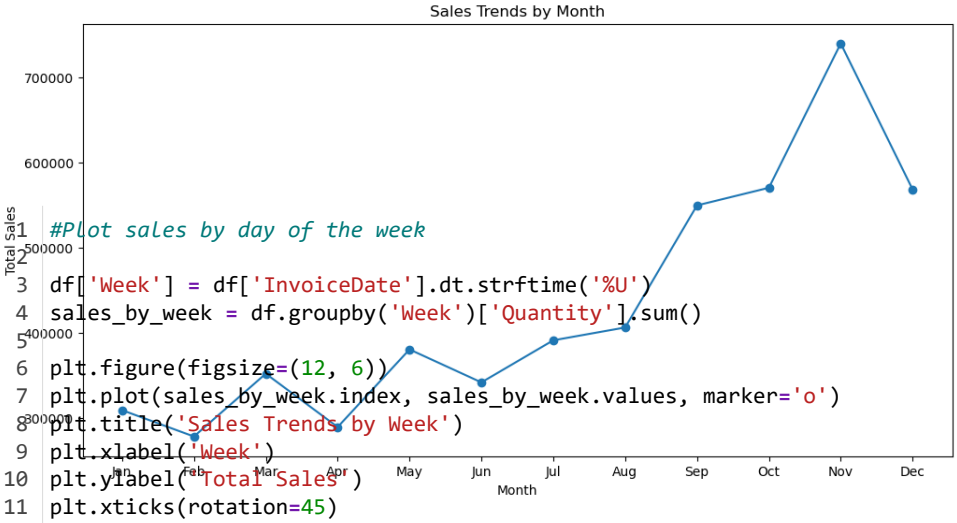
In [53]:
```
#HeatMap
sns.heatmap(df.corr(),annot=True)
plt.show()
```

Analyze sales trends over time

In [70]:
```
df['InvoiceDate'] = pd.to_datetime(df['InvoiceDate'])
```

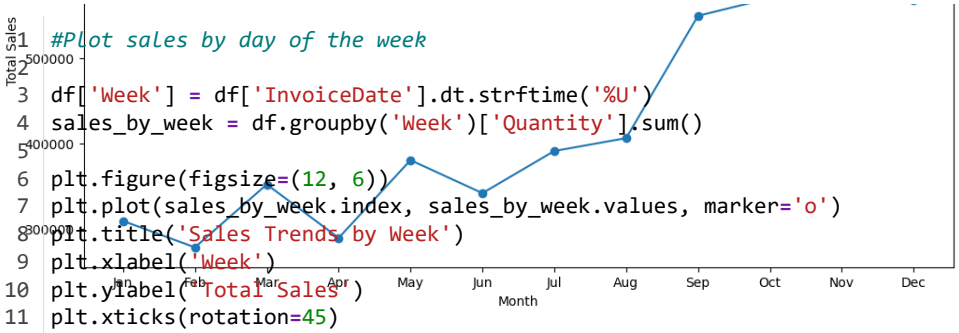
In [78]:
```
df['Month'] = df['InvoiceDate'].dt.month
df['Hour'] = df['InvoiceDate'].dt.hour

sales_by_month = df.groupby('Month')['Quantity'].sum()
```

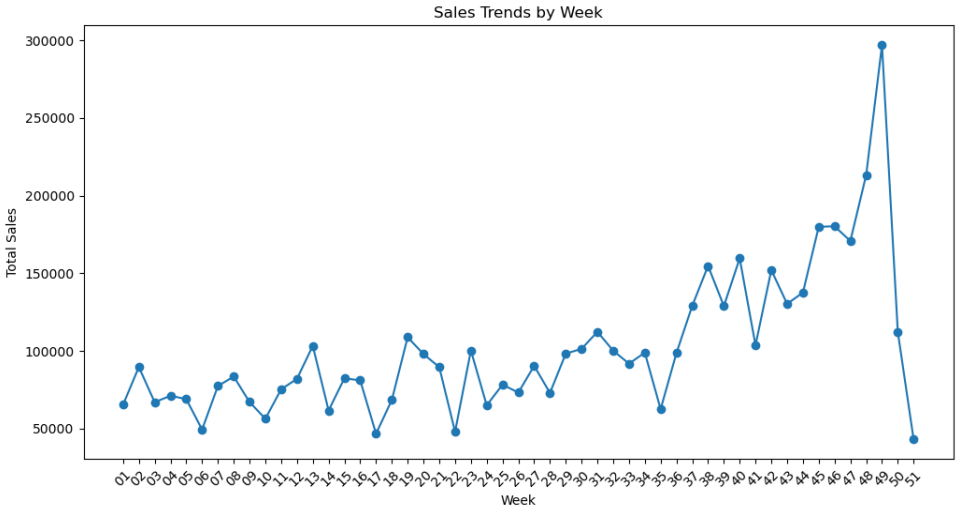
In [79]:
```
# Plot sales by month

plt.figure(figsize=(12, 6))
plt.plot(sales_by_month.index, sales_by_month.values, marker='o')
plt.title('Sales Trends by Month')
plt.xlabel('Month')
plt.ylabel('Total Sales')
plt.xticks(range(1, 13), ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul'
plt.show()

```



In [80]:
```
#Plot sales by day of the week

df['Week'] = df['InvoiceDate'].dt.strftime('%U')
sales_by_week = df.groupby('Week')['Quantity'].sum()

plt.figure(figsize=(12, 6))
plt.plot(sales_by_week.index, sales_by_week.values, marker='o')
plt.title('Sales Trends by Week')
plt.xlabel('Week')
plt.ylabel('Total Sales')
plt.xticks(rotation=45)
plt.show()
```

In [80]:
```
#Plot sales by day of the week

df['Week'] = df['InvoiceDate'].dt.strftime('%U')
sales_by_week = df.groupby('Week')['Quantity'].sum()

plt.figure(figsize=(12, 6))
plt.plot(sales_by_week.index, sales_by_week.values, marker='o')
plt.title('Sales Trends by Week')
plt.xlabel('Week')
plt.ylabel('Total Sales')
plt.xticks(rotation=45)
plt.show()
```





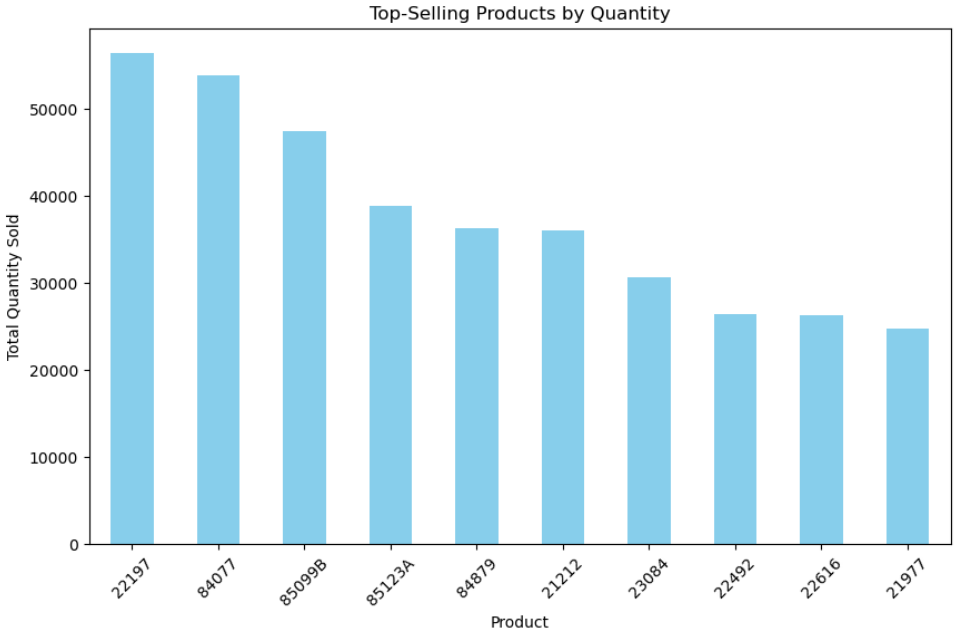
Top selling product and countries

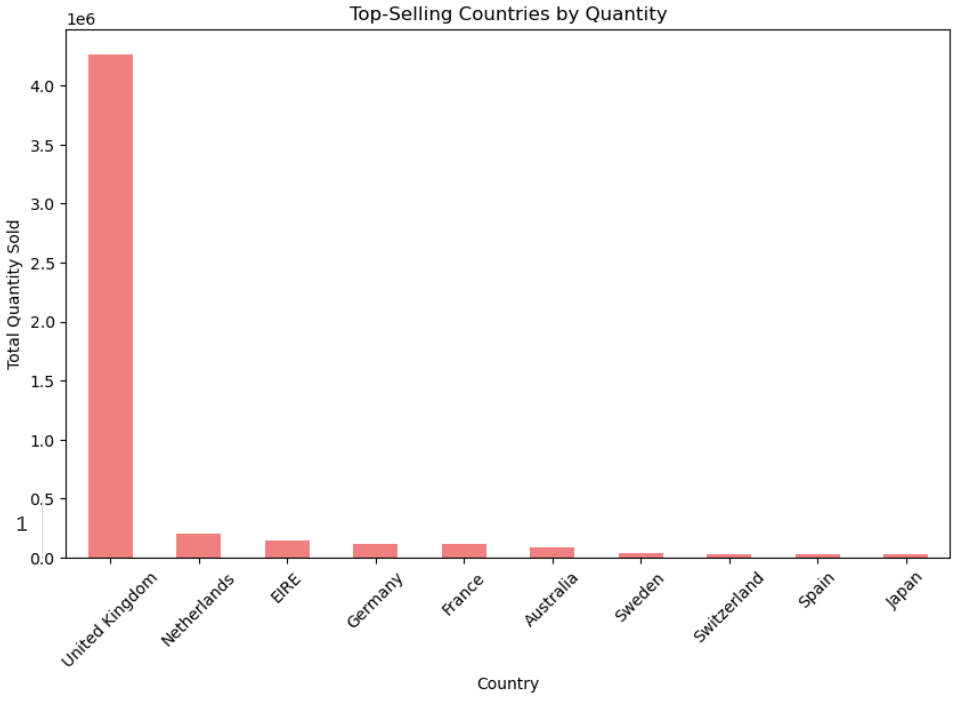
In [85]:
```
product_country_sales = df.groupby(['StockCode', 'Country'])['Quantity'].

top_selling_products = product_country_sales.groupby('StockCode')['Quanti

top_selling_countries = product_country_sales.groupby('Country')['Quantit
```

In [86]:
```
# Plot top-selling products
plt.figure(figsize=(10, 6))
top_selling_products.plot(kind='bar', color='skyblue')
plt.title('Top-Selling Products by Quantity')
plt.xlabel('Product')
plt.ylabel('Total Quantity Sold')
plt.xticks(rotation=45)
plt.show()

# Plot top-selling countries
plt.figure(figsize=(10, 6))
top_selling_countries.plot(kind='bar', color='lightcoral')
plt.title('Top-Selling Countries by Quantity')
```

In [86]:

```
# Plot top-selling products
plt.figure(figsize=(10, 6))
top_selling_products.plot(kind='bar', color='skyblue')
plt.title('Top-Selling Products by Quantity')
plt.xlabel('Product')
plt.ylabel('Total Quantity Sold')
plt.xticks(rotation=45)
plt.show()

# Plot top-selling countries
plt.figure(figsize=(10, 6))
top_selling_countries.plot(kind='bar', color='lightcoral')
plt.title('Top-Selling Countries by Quantity')
plt.xlabel('Country')
plt.ylabel('Total Quantity Sold')
plt.xticks(rotation=45)
plt.show()

```

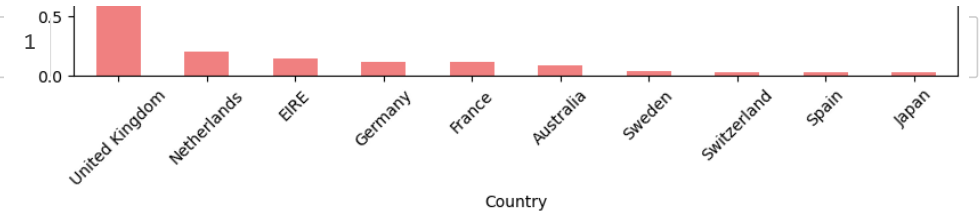




In [ ]:

```
1
```

In [ ]:


0.5
1
0.0
United Kingdom
Netherlands
EIRE
Germany
France
Australia
Sweden
Switzerland
Spain
Japan
Country