Assignment Tasks:

Task 1: Exploratory Data Analysis (EDA) and Business Insights

Sales Growth & Trends: We're seeing consistent growth or seasonal fluctuations in sales. By focusing on peak periods, we can further boost sales through targeted marketing campaigns and optimized inventory management.

Regional Customer Distribution: Sales are concentrated in certain areas, suggesting opportunities for regional marketing. Expanding efforts in underrepresented areas will balance the customer base and increase engagement.

Popular Products: Certain products are performing well. To capitalize on this, we can introduce complementary items or expand stock to meet demand, driving more sales.

Price Sensitivity: Some customers are price-sensitive, offering an opportunity for tailored pricing strategies. Time-limited discounts or promotional bundles can drive sales without hurting the brand's value.

Customer Loyalty: High-value customers contribute significantly to revenue. By offering personalized rewards and targeted loyalty programs, we can increase repeat purchases and customer retention.

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

In [2]:
```
# Load the dataset
products = pd.read_csv('Products.csv')
transactions = pd.read_csv('Transactions.csv')
customers = pd.read_csv('Customers.csv')
```

In [3]:
```
# Display basic info about the dataset
print("Products Dataframe:")
print(products.info())
print("\nTransactions Dataframe:")
print(transactions.info())
print("\nCustomers Dataframe:")
```

```
print(customers.info())

# Display the first few rows to get a sense of the data
print("\nFirst few rows of Products:")
print(products.head())
print("\nFirst few rows of Transactions:")
print(transactions.head())
print("\nFirst few rows of Customers:")
print(customers.head())
```

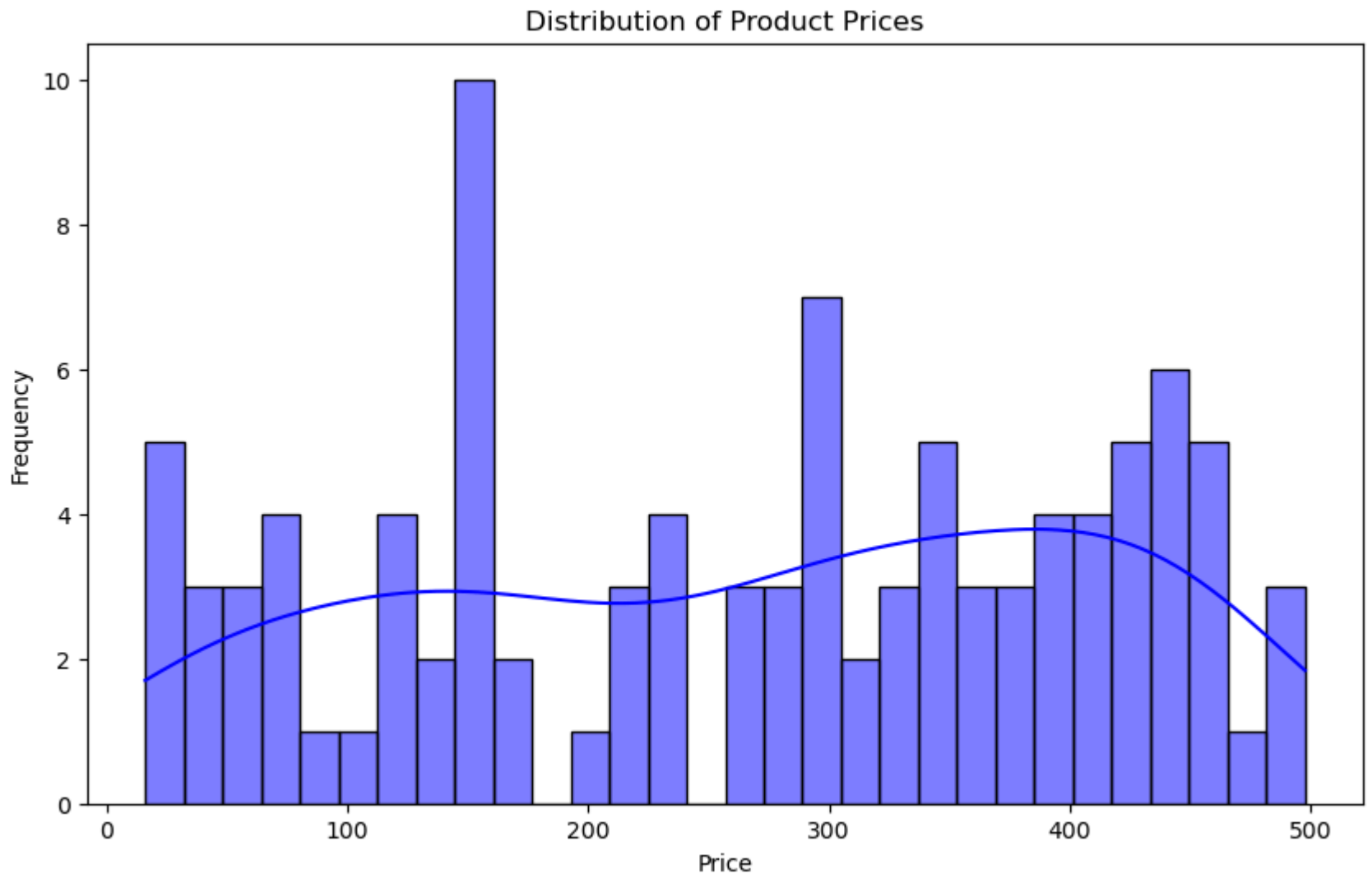
```
Products Dataframe:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 100 entries, 0 to 99
Data columns (total 4 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   ProductID    100 non-null    object
 1   ProductName  100 non-null    object
 2   Category     100 non-null    object
 3   Price        100 non-null    float64
dtypes: float64(1), object(3)
memory usage: 3.2+ KB
None

Transactions Dataframe:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 7 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   TransactionID    1000 non-null   object
 1   CustomerID       1000 non-null   object
 2   ProductID        1000 non-null   object
 3   TransactionDate  1000 non-null   object
 4   Quantity         1000 non-null   int64
 5   TotalValue       1000 non-null   float64
 6   Price            1000 non-null   float64
dtypes: float64(2), int64(1), object(4)
memory usage: 54.8+ KB
None

Customers Dataframe:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 4 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   CustomerID    200 non-null    object
 1   CustomerName  200 non-null    object
 2   Region        200 non-null    object
 3   SignupDate    200 non-null    object
dtypes: object(4)
memory usage: 6.4+ KB
None
```

```
First few rows of Products:
  ProductID              ProductName     Category   Price
0      P001     ActiveWear Biography        Books  169.30
1      P002    ActiveWear Smartwatch  Electronics  346.30
2      P003  ComfortLiving Biography        Books   44.12
3      P004            BookWorld Rug   Home Decor   95.69
4      P005          TechPro T-Shirt     Clothing  429.31

First few rows of Transactions:
  TransactionID CustomerID ProductID      TransactionDate  Quantity  \
0        T00001      C0199      P067  2024-08-25 12:38:23         1
1        T00112      C0146      P067  2024-05-27 22:23:54         1
2        T00166      C0127      P067  2024-04-25 07:38:55         1
3        T00272      C0087      P067  2024-03-26 22:55:37         2
4        T00363      C0070      P067  2024-03-21 15:10:10         3

   TotalValue   Price
0      300.68  300.68
1      300.68  300.68
2      300.68  300.68
3      601.36  300.68
4      902.04  300.68

First few rows of Customers:
  CustomerID        CustomerName         Region  SignupDate
0      C0001    Lawrence Carroll  South America  2022-07-10
1      C0002      Elizabeth Lutz           Asia  2022-02-13
2      C0003      Michael Rivera  South America  2024-03-07
3      C0004  Kathleen Rodriguez  South America  2022-10-09
4      C0005         Laura Weber           Asia  2022-08-15
```

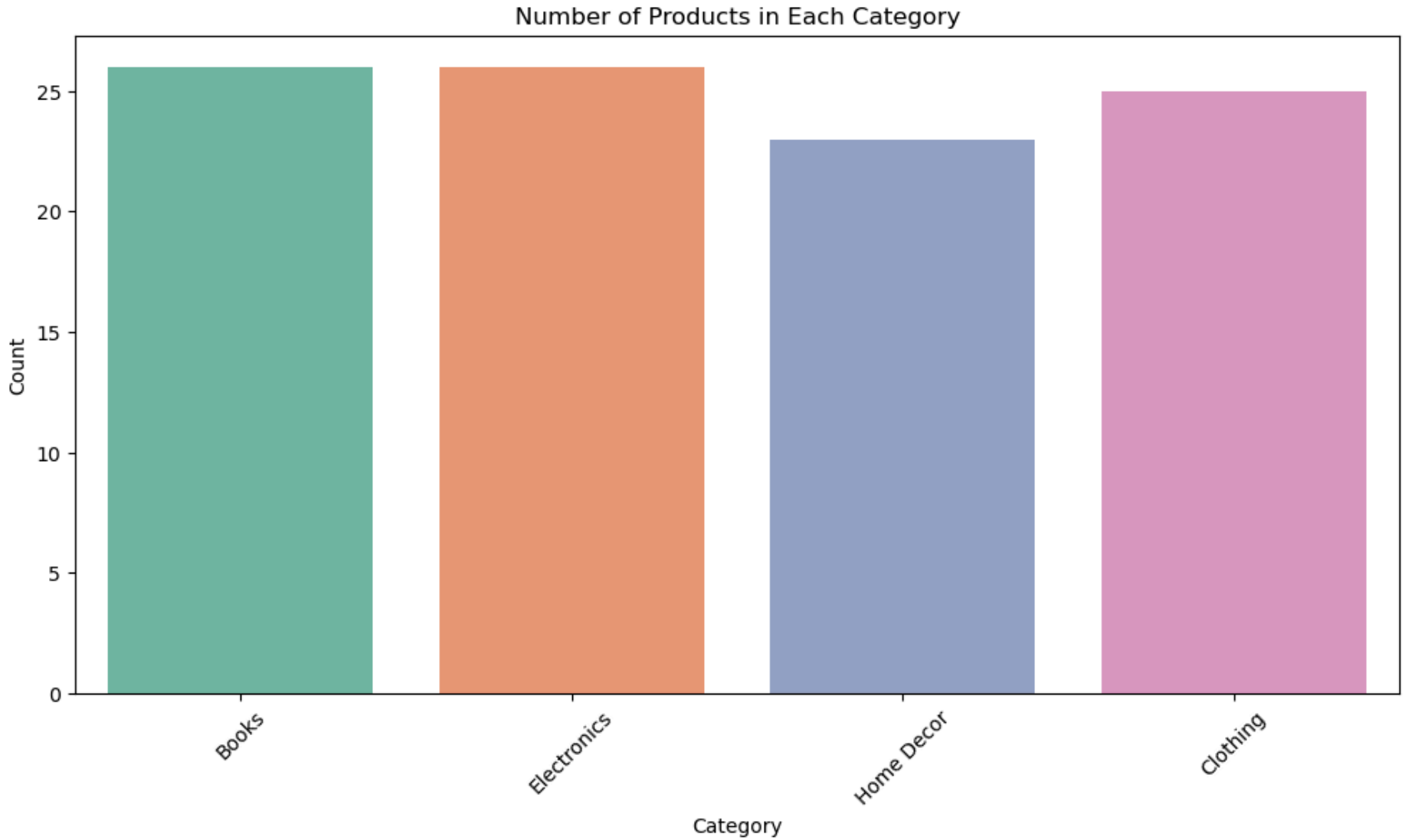
In [4]:

```python
# EDA: Distribution of Prices
plt.figure(figsize=(10,6))
sns.histplot(products['Price'], kde=True, color='blue', bins=30)
plt.title('Distribution of Product Prices')
plt.xlabel('Price')
plt.ylabel('Frequency')
plt.show()

# EDA: Count of Products in Each Category
plt.figure(figsize=(12,6))
sns.countplot(data=products, x='Category', palette='Set2')
plt.title('Number of Products in Each Category')
```

```
plt.xticks(rotation=45)
plt.ylabel('Count')
plt.show()
```

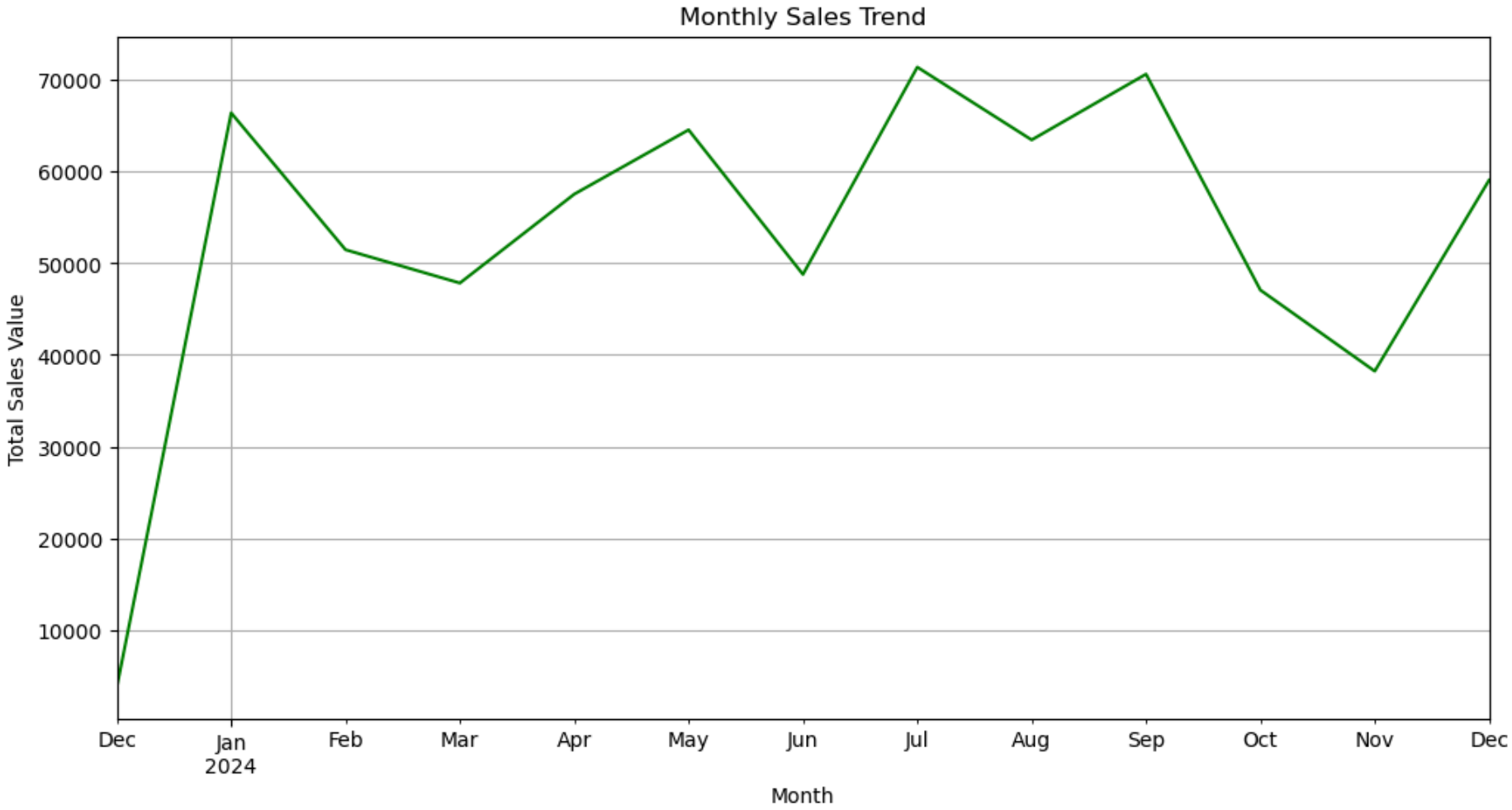



```
C:\Users\gokul\AppData\Local\Temp\ipykernel_17416\847584733.py:11: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.countplot(data=products, x='Category', palette='Set2')
```

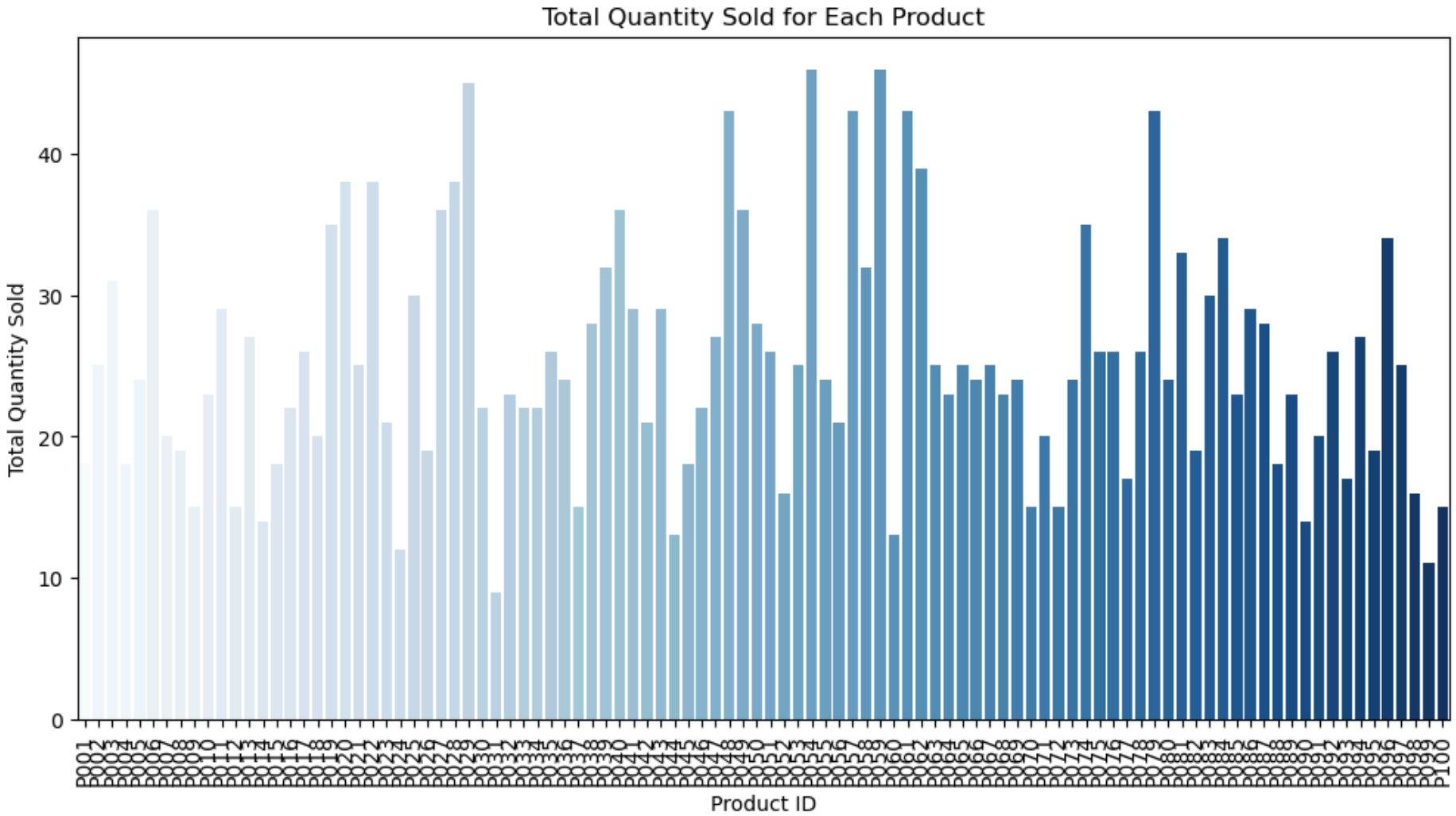


In [5]:
```
# EDA: Total Transaction Value Over Time (Date-based)
transactions['TransactionDate'] = pd.to_datetime(transactions['TransactionDate'])
transactions['YearMonth'] = transactions['TransactionDate'].dt.to_period('M')
monthly_sales = transactions.groupby('YearMonth')['TotalValue'].sum()

plt.figure(figsize=(12,6))
monthly_sales.plot(kind='line', color='green')
plt.title('Monthly Sales Trend')
```

```
plt.xlabel('Month')
plt.ylabel('Total Sales Value')
plt.grid(True)
plt.show()

# EDA: Total Quantity Sold for Each Product
product_sales = transactions.groupby('ProductID')['Quantity'].sum().reset_index()

plt.figure(figsize=(12,6))
sns.barplot(data=product_sales, x='ProductID', y='Quantity', palette='Blues')
plt.title('Total Quantity Sold for Each Product')
plt.xticks(rotation=90)
plt.xlabel('Product ID')
plt.ylabel('Total Quantity Sold')
plt.show()
```




```
C:\Users\gokul\AppData\Local\Temp\ipykernel_17416\3044900396.py:18: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.barplot(data=product_sales, x='ProductID', y='Quantity', palette='Blues')
```



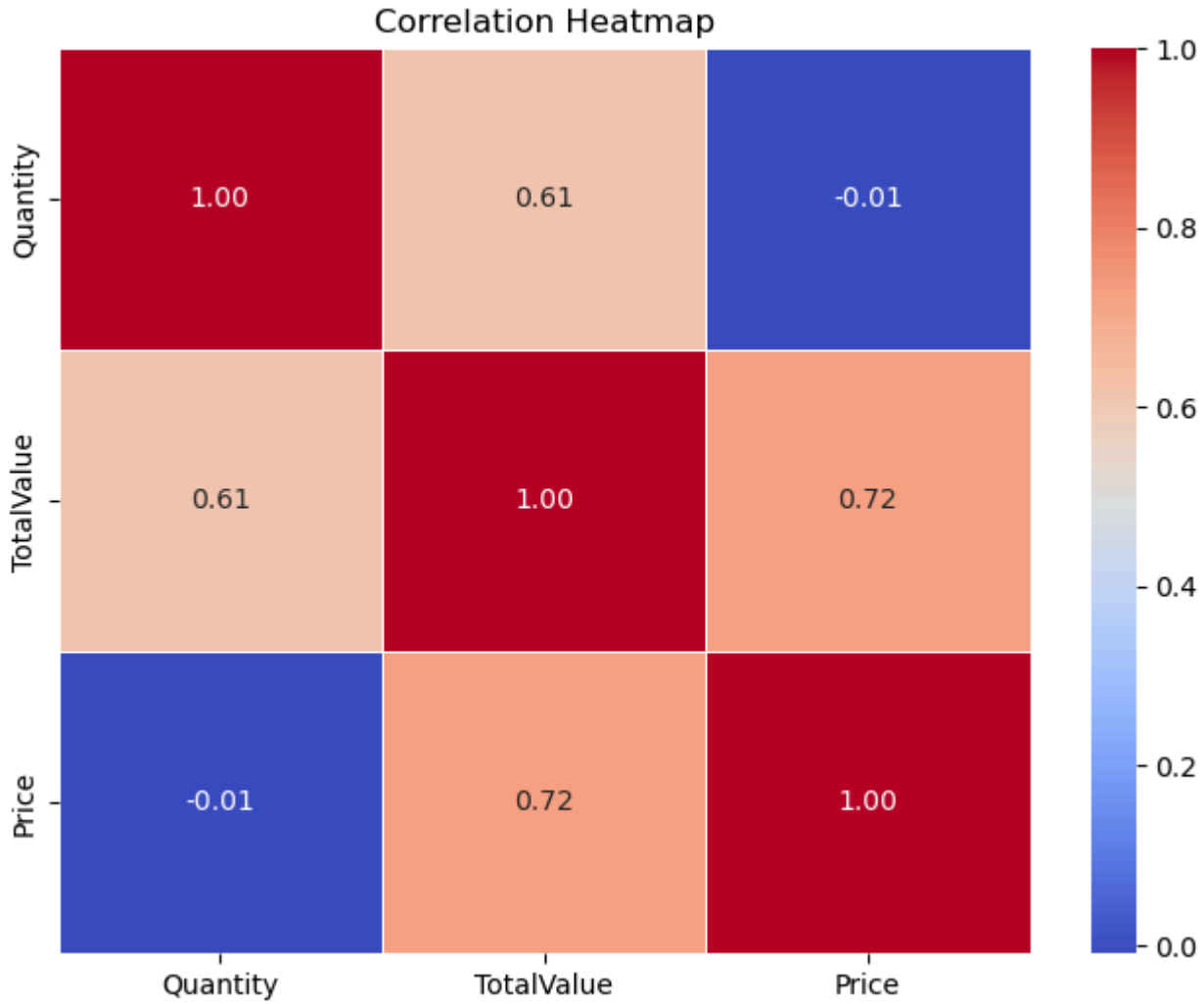
In [6]:
```
# EDA: Customer Distribution by Region
plt.figure(figsize=(10,6))
sns.countplot(data=customers, x='Region', palette='Set3')
plt.title('Number of Customers by Region')
plt.xlabel('Region')
plt.ylabel('Count')
plt.show()

# EDA: Relationship Between Total Spending and Customer Region
customer_spending = transactions.groupby('CustomerID')['TotalValue'].sum().reset_index()
```

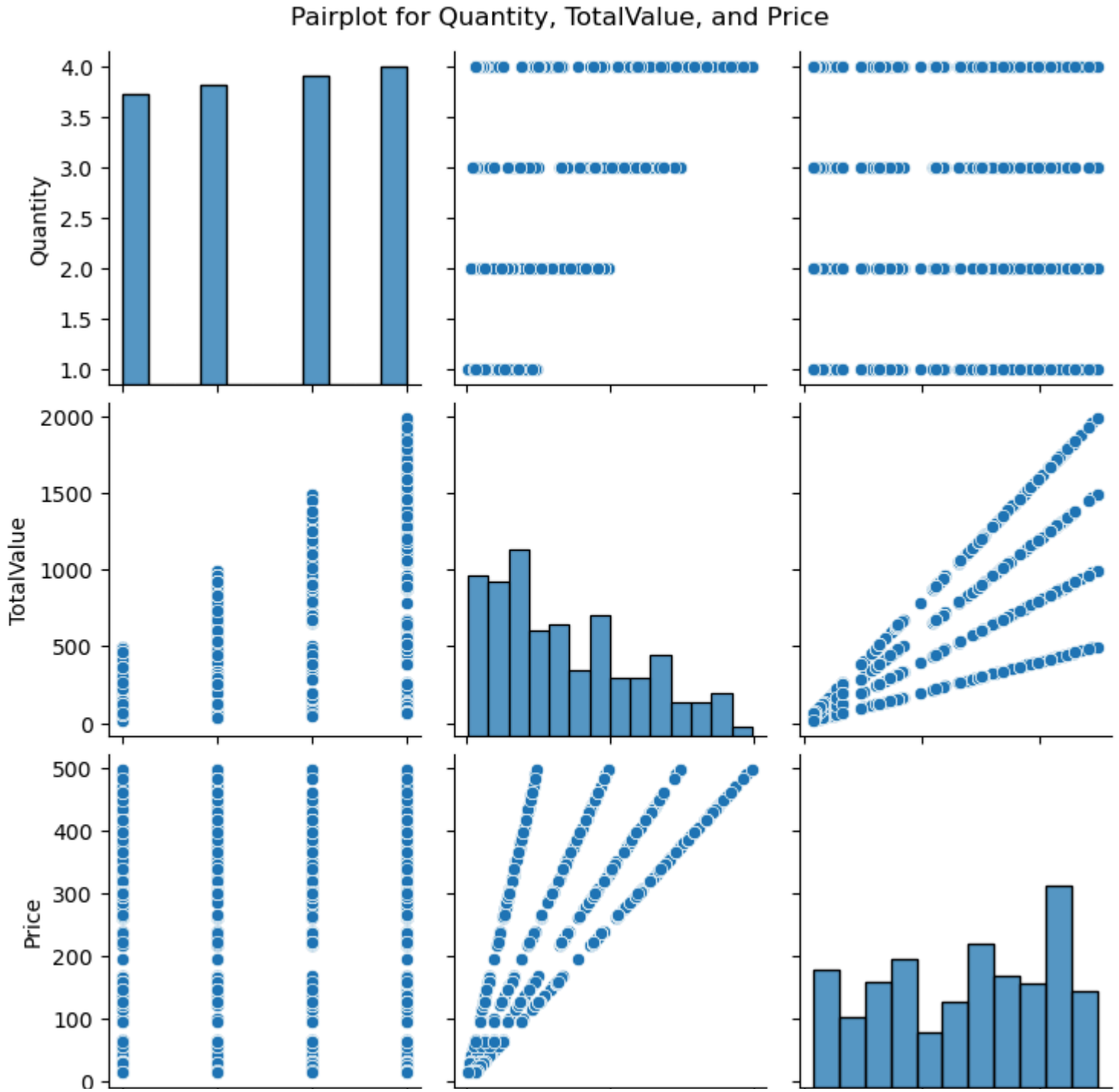
```
customer_spending = customer_spending.merge(customers, on='CustomerID', how='left')

plt.figure(figsize=(12,6))
sns.boxplot(data=customer_spending, x='Region', y='TotalValue', palette='coolwarm')
plt.title('Total Spending Distribution by Region')
plt.xlabel('Region')
plt.ylabel('Total Spending')
plt.show()
```

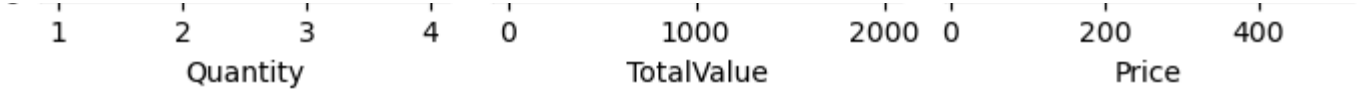
```
C:\Users\gokul\AppData\Local\Temp\ipykernel_17416\915420517.py:3: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.countplot(data=customers, x='Region', palette='Set3')
```


```
C:\Users\gokul\AppData\Local\Temp\ipykernel_17416\915420517.py:14: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.boxplot(data=customer_spending, x='Region', y='TotalValue', palette='coolwarm')
```

In [7]:
```
# EDA: Correlation Heatmap for Numeric Columns (Transactions Data)
corr_matrix = transactions[['Quantity', 'TotalValue', 'Price']].corr()

plt.figure(figsize=(8,6))
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', fmt='.2f', linewidths=0.5)
plt.title('Correlation Heatmap')
plt.show()

# EDA: Pairplot to Understand Relationship Between Multiple Features
sns.pairplot(transactions[['Quantity', 'TotalValue', 'Price']])
plt.suptitle('Pairplot for Quantity, TotalValue, and Price', y=1.02)
plt.show()
```

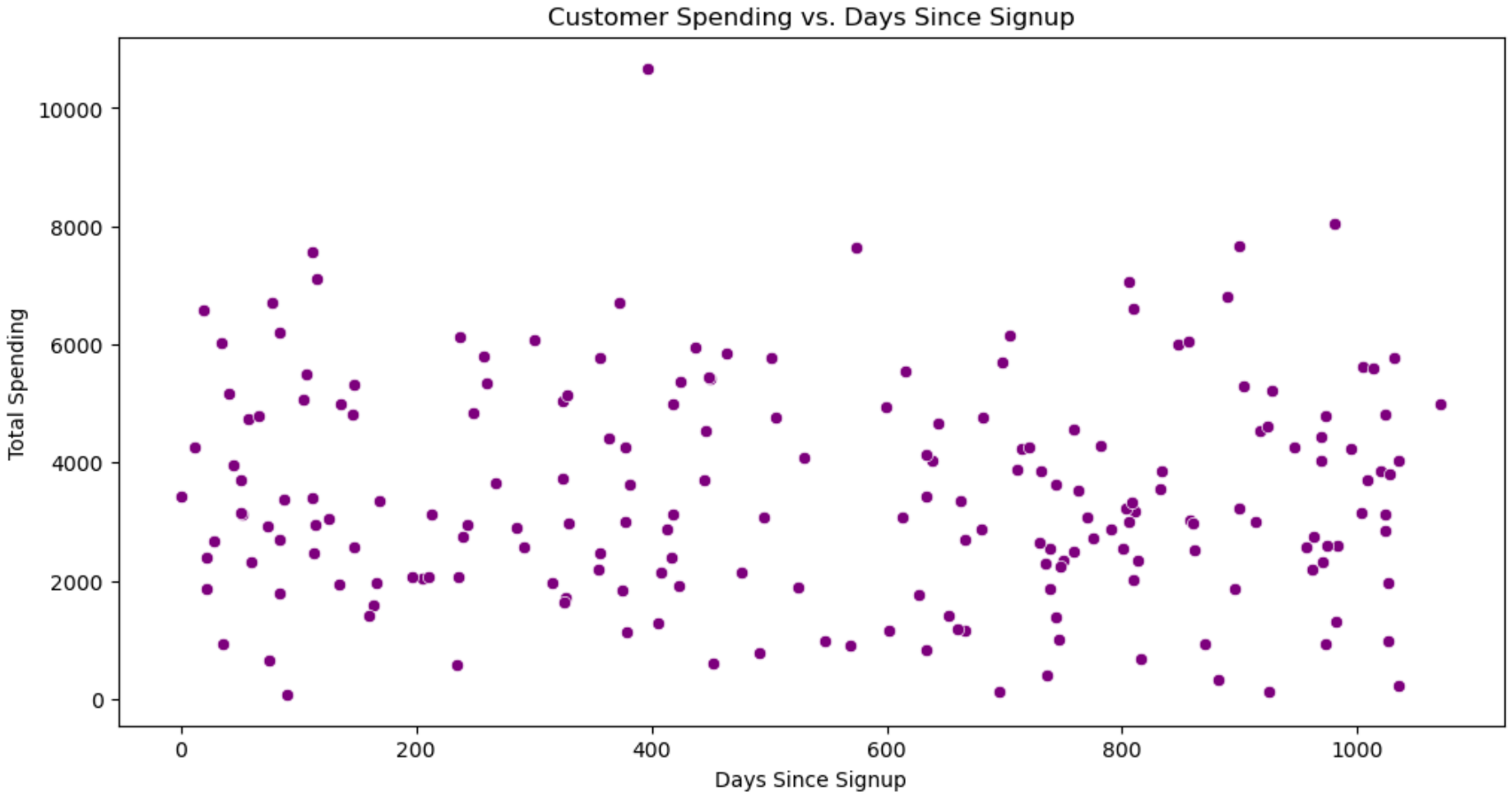

Correlation Heatmap
Quantity
TotalValue
Price
1.00
0.61
-0.01
0.61
1.00
0.72
-0.01
0.72
1.00
Quantity
TotalValue
Price
1.0
0.8
0.6
0.4
0.2
0.0


Pairplot for Quantity, TotalValue, and Price
Quantity
TotalValue
Price
4.0
3.5
3.0
2.5
2.0
1.5
1.0
2000
1500
1000
500
0
500
400
300
200
100
0



In [8]:

```
# EDA: Customer Spending vs. Signup Date
customers['SignupDate'] = pd.to_datetime(customers['SignupDate'])
customer_spending['SignupDate'] = customer_spending['CustomerID'].map(customers.set_index('CustomerID')['SignupDate'])
customer_spending['DaysSinceSignup'] = (customer_spending['SignupDate'] - customer_spending['SignupDate'].min()).dt.days

plt.figure(figsize=(12,6))
sns.scatterplot(data=customer_spending, x='DaysSinceSignup', y='TotalValue', color='purple')
plt.title('Customer Spending vs. Days Since Signup')
plt.xlabel('Days Since Signup')
plt.ylabel('Total Spending')
plt.show()
```


Customer Spending vs. Days Since Signup
Total Spending
Days Since Signup
0
2000
4000
6000
8000
10000
0
200
400
600
800
1000

In [ ]: