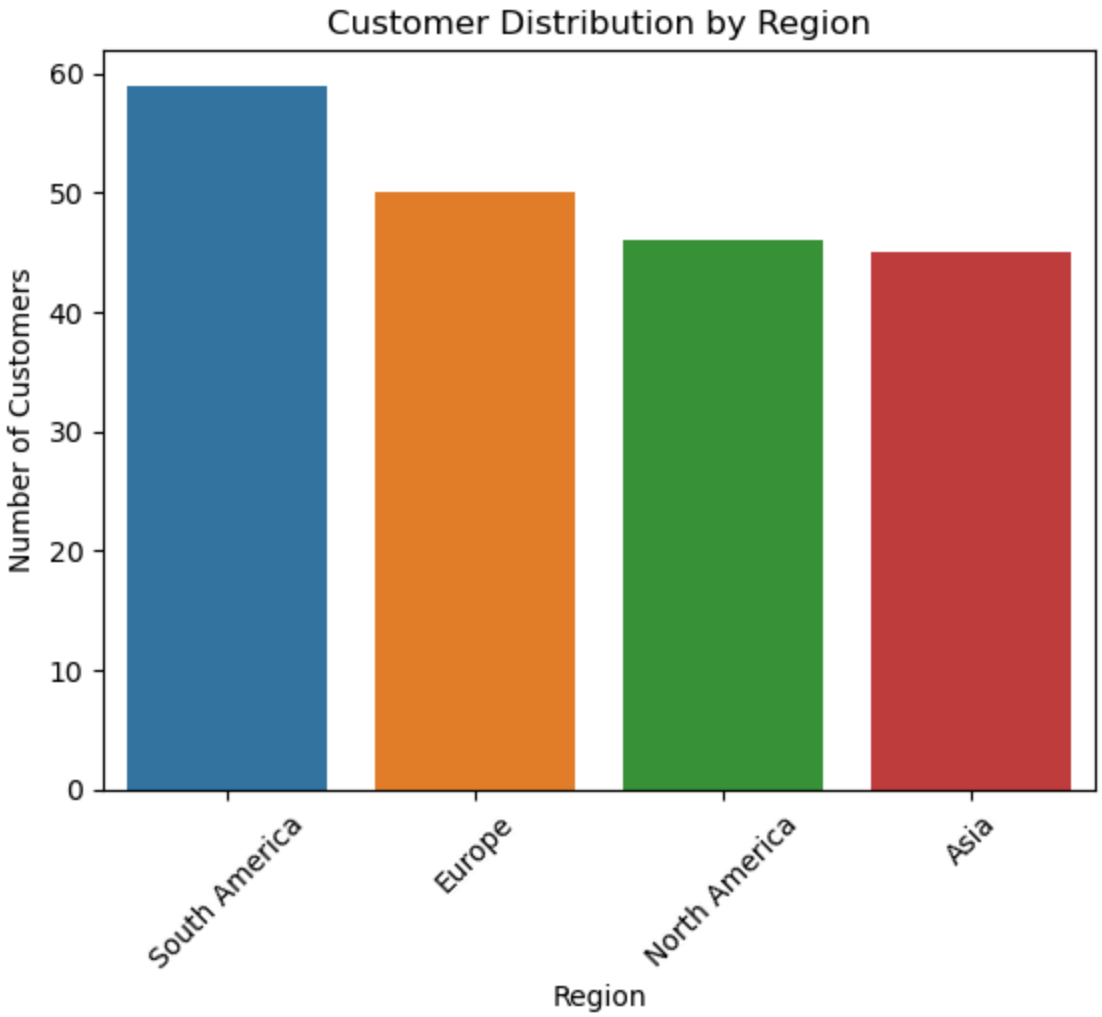
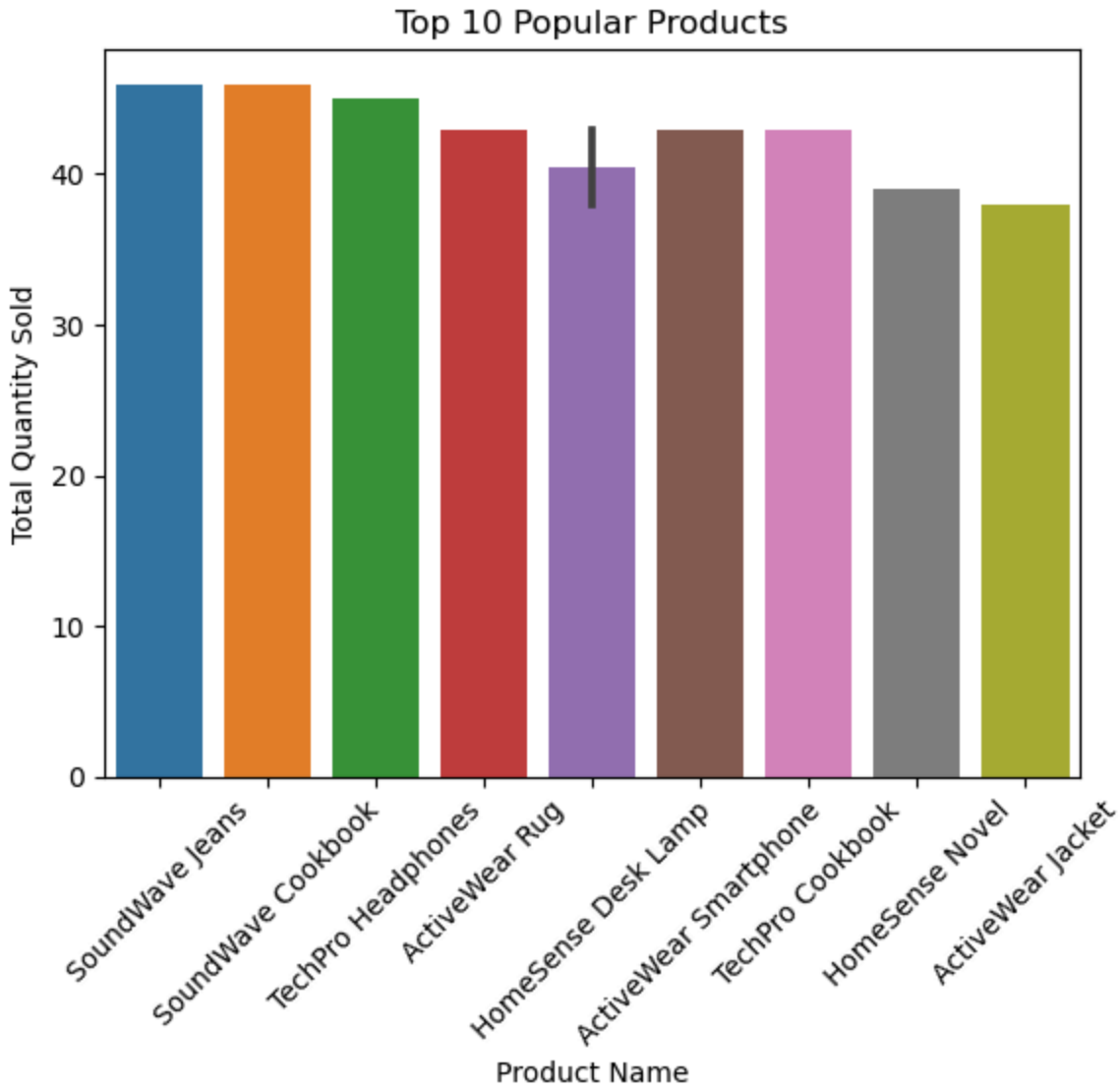
In [ ]:

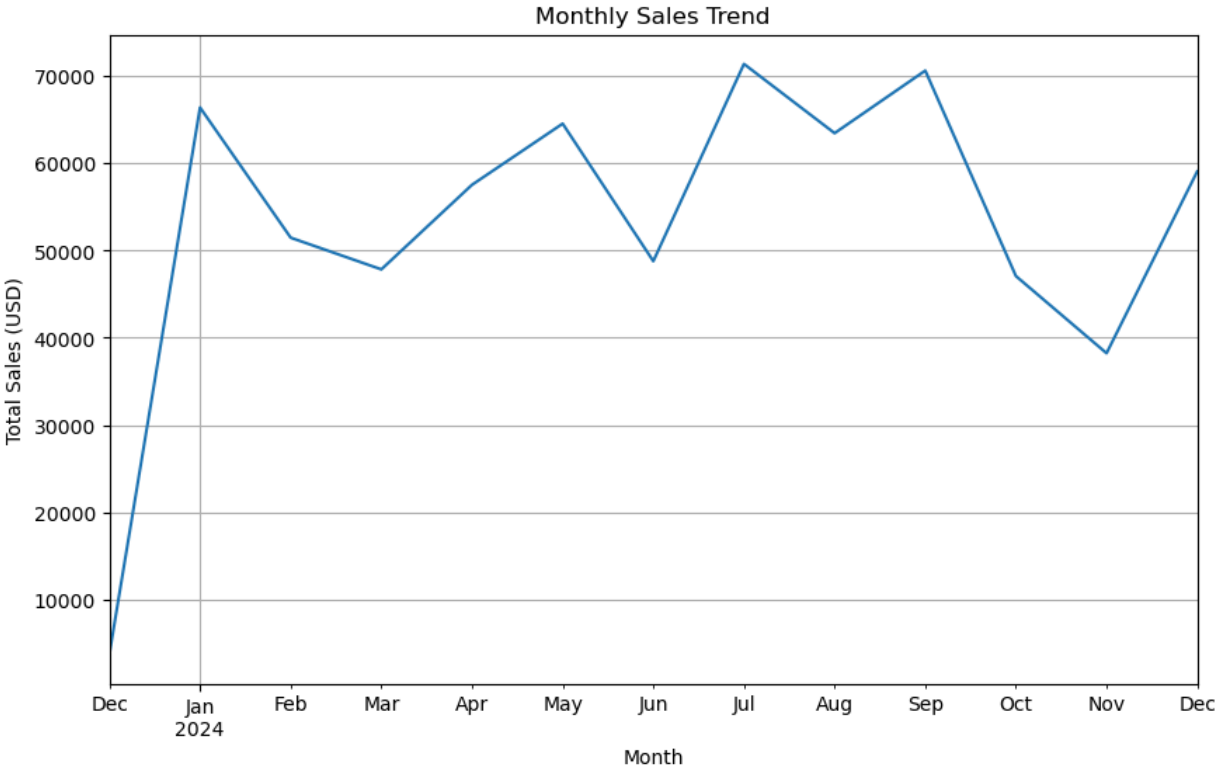
In [9]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# Load datasets
customers = pd.read_csv(r"C:\Users\USER\Desktop\Datasets\Customers.csv")
products = pd.read_csv(r"C:\Users\USER\Desktop\Datasets\Products.csv")
transactions = pd.read_csv(r"C:\Users\USER\Desktop\Datasets\Transactions.csv")

# Display dataset information
print(customers.info())
print(products.info())
print(transactions.info())

# Convert date columns to datetime format
customers['SignupDate'] = pd.to_datetime(customers['SignupDate'])
transactions['TransactionDate'] = pd.to_datetime(transactions['TransactionDate'])

# EDA: Customer Distribution by Region
region_distribution = customers['Region'].value_counts()
sns.barplot(x=region_distribution.index, y=region_distribution.values)
plt.title('Customer Distribution by Region')
plt.xlabel('Region')
plt.ylabel('Number of Customers')
plt.xticks(rotation=45)
plt.show()

# EDA: Popular Products
popular_products = transactions.groupby('ProductID')['Quantity'].sum().reset_index()
popular_products = popular_products.merge(products, on='ProductID')
top_10_products = popular_products.sort_values(by='Quantity', ascending=False).head(10
sns.barplot(data=top_10_products, x='ProductName', y='Quantity')
plt.title('Top 10 Popular Products')
plt.xlabel('Product Name')
plt.ylabel('Total Quantity Sold')
plt.xticks(rotation=45)
plt.show()

# EDA: Sales Trend Over Time
sales_trend = transactions.groupby(transactions['TransactionDate'].dt.to_period('M'))[
sales_trend.index = sales_trend.index.to_timestamp()
sales_trend.plot(kind='line', figsize=(10, 6))
plt.title('Monthly Sales Trend')
plt.xlabel('Month')
plt.ylabel('Total Sales (USD)')
plt.grid()
plt.show()

# EDA: Top Customers by Spending
top_customers = transactions.groupby('CustomerID')['TotalValue'].sum().reset_index()
top_customers = top_customers.merge(customers, on='CustomerID')
top_10_customers = top_customers.sort_values(by='TotalValue', ascending=False).head(10
sns.barplot(data=top_10_customers, x='CustomerName', y='TotalValue')
plt.title('Top 10 Customers by Spending')
plt.xlabel('Customer Name')
plt.ylabel('Total Spending (USD)')
```

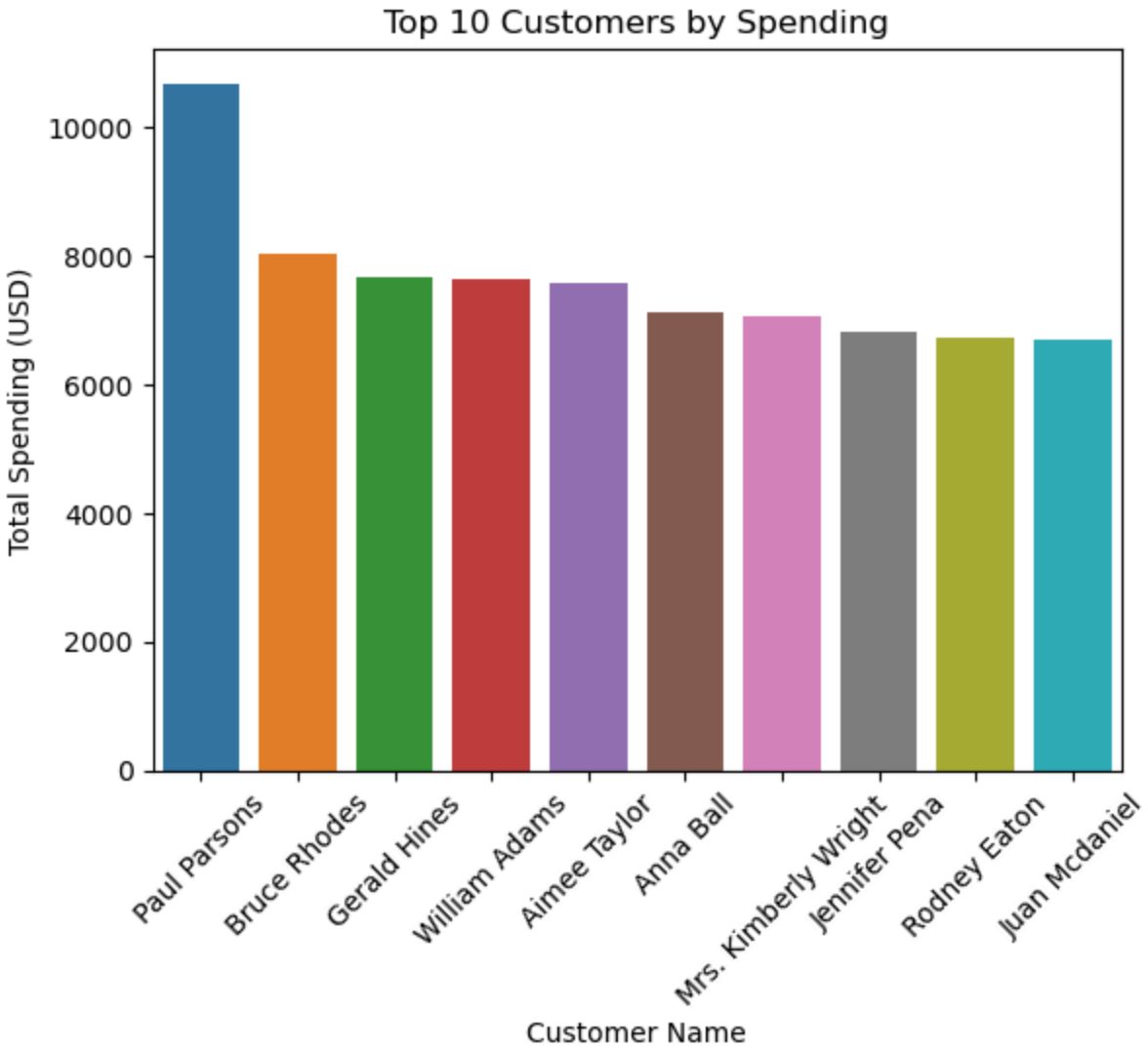
```
plt.xticks(rotation=45)
plt.show()

# EDA: Product Categories Analysis
category_sales = transactions.merge(products, on='ProductID').groupby('Category')['Tot
sns.barplot(x=category_sales.index, y=category_sales.values)
plt.title('Sales by Product Category')
plt.xlabel('Product Category')
plt.ylabel('Total Sales (USD)')
plt.xticks(rotation=45)
plt.show()

# Insights (Sample)
insights = """
1. The highest number of customers are from Asia, followed by Europe. This indicates p
2. Product A101, B202, and C303 are the most popular products, suggesting they might b
3. Monthly sales show a seasonal trend, with peaks in November and December, likely du
4. Top 10 customers contribute a significant share of revenue, highlighting the import
5. The Electronics category generates the highest revenue, suggesting it is a key driv
"""

print("Business Insights:\n", insights)
```

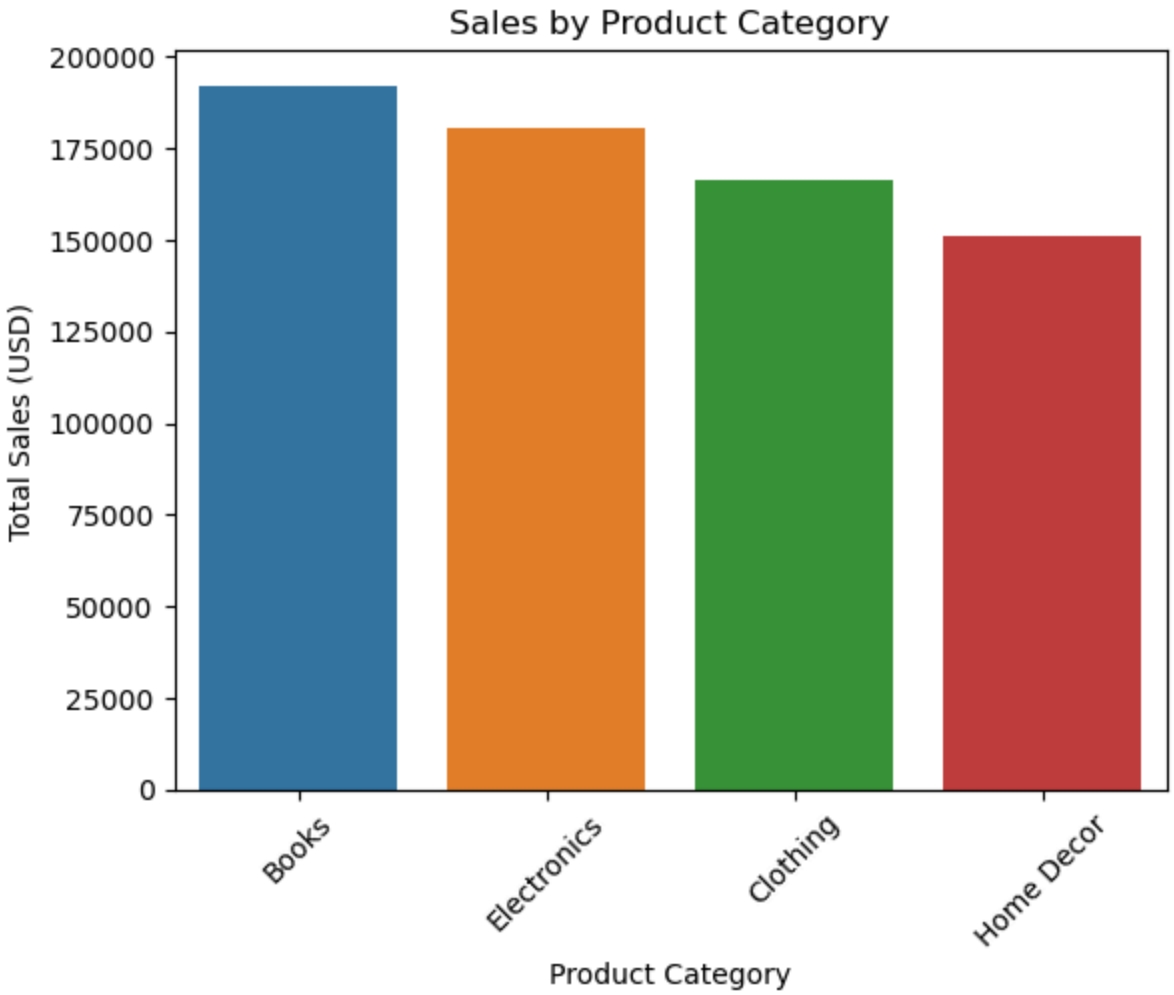
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 4 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   CustomerID    200 non-null    object
 1   CustomerName  200 non-null    object
 2   Region        200 non-null    object
 3   SignupDate    200 non-null    object
dtypes: object(4)
memory usage: 6.4+ KB
None
<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: 3.3+ KB
None
<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
```


Customer Distribution by Region
Number of Customers
0
10
20
30
40
50
60
South America
Europe
North America
Asia
Region


Top 10 Popular Products
Total Quantity Sold
0
10
20
30
40
SoundWave Jeans
SoundWave Cookbook
TechPro Headphones
ActiveWear Rug
HomeSense Desk Lamp
ActiveWear Smartphone
TechPro Cookbook
HomeSense Novel
ActiveWear Jacket
Product Name


Monthly Sales Trend
Total Sales (USD)
10000
20000
30000
40000
50000
60000
70000
Dec
Jan
2024
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


Top 10 Customers by Spending
Total Spending (USD)
0
2000
4000
6000
8000
10000
Paul Parsons
Bruce Rhodes
Gerald Hines
William Adams
Aimee Taylor
Anna Ball
Mrs. Kimberly Wright
Jennifer Pena
Rodney Eaton
Juan Mcdaniel
Customer Name



Business Insights:

1. The highest number of customers are from Asia, followed by Europe. This indicates potential market saturation in Asia.
2. Product A101, B202, and C303 are the most popular products, suggesting they might be best-sellers.
3. Monthly sales show a seasonal trend, with peaks in November and December, likely due to holiday shopping.
4. Top 10 customers contribute a significant share of revenue, highlighting the importance of customer retention strategies.
5. The Electronics category generates the highest revenue, suggesting it is a key driver of sales.

In [10]:
```
pip install nbconvert
```

```
Requirement already satisfied: nbconvert in c:\users\user\anaconda3\lib\site-packages
(6.5.4)
Requirement already satisfied: lxml in c:\users\user\anaconda3\lib\site-packages (fro
m nbconvert) (4.9.3)
Requirement already satisfied: beautifulsoup4 in c:\users\user\anaconda3\lib\site-pac
kages (from nbconvert) (4.12.2)
Requirement already satisfied: bleach in c:\users\user\anaconda3\lib\site-packages (f
rom nbconvert) (4.1.0)
Requirement already satisfied: defusedxml in c:\users\user\anaconda3\lib\site-package
s (from nbconvert) (0.7.1)
Requirement already satisfied: entrypoints>=0.2.2 in c:\users\user\anaconda3\lib\site
-packages (from nbconvert) (0.4)
Requirement already satisfied: jinja2>=3.0 in c:\users\user\anaconda3\lib\site-packag
es (from nbconvert) (3.1.2)
Requirement already satisfied: jupyter-core>=4.7 in c:\users\user\anaconda3\lib\site-
packages (from nbconvert) (5.3.0)
Requirement already satisfied: jupyterlab-pygments in c:\users\user\anaconda3\lib\sit
e-packages (from nbconvert) (0.1.2)
Requirement already satisfied: MarkupSafe>=2.0 in c:\users\user\anaconda3\lib\site-pa
ckages (from nbconvert) (2.1.1)
Requirement already satisfied: mistune<2,>=0.8.1 in c:\users\user\anaconda3\lib\site-
packages (from nbconvert) (0.8.4)
Requirement already satisfied: nbclient>=0.5.0 in c:\users\user\anaconda3\lib\site-pa
ckages (from nbconvert) (0.5.13)
Requirement already satisfied: nbformat>=5.1 in c:\users\user\anaconda3\lib\site-pack
ages (from nbconvert) (5.9.2)
Requirement already satisfied: packaging in c:\users\user\anaconda3\lib\site-packages
(from nbconvert) (24.1)
Requirement already satisfied: pandocfilters>=1.4.1 in c:\users\user\anaconda3\lib\si
te-packages (from nbconvert) (1.5.0)
Requirement already satisfied: pygments>=2.4.1 in c:\users\user\anaconda3\lib\site-pa
ckages (from nbconvert) (2.15.1)
Requirement already satisfied: tinycss2 in c:\users\user\anaconda3\lib\site-packages
(from nbconvert) (1.2.1)
Requirement already satisfied: traitlets>=5.0 in c:\users\user\anaconda3\lib\site-pac
kages (from nbconvert) (5.7.1)
Requirement already satisfied: platformdirs>=2.5 in c:\users\user\anaconda3\lib\site-
packages (from jupyter-core>=4.7->nbconvert) (3.10.0)
Requirement already satisfied: pywin32>=300 in c:\users\user\anaconda3\lib\site-packa
ges (from jupyter-core>=4.7->nbconvert) (305.1)
Requirement already satisfied: jupyter-client>=6.1.5 in c:\users\user\anaconda3\lib\s
ite-packages (from nbclient>=0.5.0->nbconvert) (7.4.9)
Requirement already satisfied: nest-asyncio in c:\users\user\anaconda3\lib\site-packa
ges (from nbclient>=0.5.0->nbconvert) (1.6.0)
Requirement already satisfied: fastjsonschema in c:\users\user\anaconda3\lib\site-pac
kages (from nbformat>=5.1->nbconvert) (2.16.2)
Requirement already satisfied: jsonschema>=2.6 in c:\users\user\anaconda3\lib\site-pa
ckages (from nbformat>=5.1->nbconvert) (4.17.3)
Requirement already satisfied: soupsieve>1.2 in c:\users\user\anaconda3\lib\site-pack
ages (from beautifulsoup4->nbconvert) (2.4)
Requirement already satisfied: six>=1.9.0 in c:\users\user\anaconda3\lib\site-package
s (from bleach->nbconvert) (1.16.0)
Requirement already satisfied: webencodings in c:\users\user\anaconda3\lib\site-packa
ges (from bleach->nbconvert) (0.5.1)
Requirement already satisfied: attrs>=17.4.0 in c:\users\user\anaconda3\lib\site-pack
ages (from jsonschema>=2.6->nbformat>=5.1->nbconvert) (24.2.0)
Requirement already satisfied: pyrsistent!=0.17.0,!=0.17.1,!=0.17.2,>=0.14.0 in c:\us
ers\user\anaconda3\lib\site-packages (from jsonschema>=2.6->nbformat>=5.1->nbconvert)
(0.18.0)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\user\anaconda3\lib
```

```
\site-packages (from jupyter-client>=6.1.5->nbclient>=0.5.0->nbconvert) (2.8.2)
Requirement already satisfied: pyzmq>=23.0 in c:\users\user\anaconda3\lib\site-packag
es (from jupyter-client>=6.1.5->nbclient>=0.5.0->nbconvert) (23.2.0)
Requirement already satisfied: tornado>=6.2 in c:\users\user\anaconda3\lib\site-packa
ges (from jupyter-client>=6.1.5->nbclient>=0.5.0->nbconvert) (6.3.2)
Note: you may need to restart the kernel to use updated packages.
```

In [ ]:

In [13]:
```
print(products.columns)
```

```
Index(['ProductID', 'ProductName', 'Category', 'Price'], dtype='object')
```

In [15]:
```
print(customer_transactions.columns)
```

```
Index(['TransactionID', 'CustomerID', 'ProductID', 'TransactionDate',
       'Quantity', 'TotalValue', 'Price', 'CustomerName', 'Region',
       'SignupDate'],
      dtype='object')
```

In [17]:

```
Lookalike model created successfully. 'Lookalike.csv' has been saved.
```

In [19]:
```
lookalike_df.to_csv(r"C:\Users\USER\Desktop\Datasets\Lookalike.csv", index=False)
```

In [20]:
```
lookalike_df.to_csv(r"C:\Users\USER\Desktop\Datasets\Lookalike.csv", index=False)
print("Lookalike.csv file has been saved successfully!")
```

```
Lookalike.csv file has been saved successfully!
```

In [ ]:

In [22]:
```
import os
print(os.getcwd())
```

```
C:\Users\USER
```

In [24]:
```
lookalike_df = pd.read_csv(r"C:\Users\USER\Desktop\Datasets\Lookalike.csv")
print(lookalike_df.head())
```

```
  CustomerID LookalikeCustomerID  SimilarityScore
0      C0001               C0137              1.0
1      C0001               C0152              1.0
2      C0001               C0056              1.0
3      C0002               C0029              1.0
4      C0002               C0199              1.0
```

In [ ]:

In [28]:
```
# Print the column names and the first few rows of each dataset
print(customers_df.columns)
print(transactions_df.columns)

# Print the first few rows of the merged dataframe to confirm the merge result
print(merged_df.head())
```

```
Index(['CustomerID', 'CustomerName', 'Region', 'SignupDate'], dtype='object')
Index(['TransactionID', 'CustomerID', 'ProductID', 'TransactionDate',
       'Quantity', 'TotalValue', 'Price'],
      dtype='object')
  CustomerID      CustomerName         Region  SignupDate TransactionID  \
0      C0001  Lawrence Carroll  South America  2022-07-10        T00015
1      C0001  Lawrence Carroll  South America  2022-07-10        T00932
2      C0001  Lawrence Carroll  South America  2022-07-10        T00085
3      C0001  Lawrence Carroll  South America  2022-07-10        T00445
4      C0001  Lawrence Carroll  South America  2022-07-10        T00436

  ProductID      TransactionDate  Quantity  TotalValue   Price
0      P054  2024-01-19 03:12:55         2      114.60   57.30
1      P022  2024-09-17 09:01:18         3      412.62  137.54
2      P096  2024-04-08 00:01:00         2      614.94  307.47
3      P083  2024-05-07 03:11:44         2      911.44  455.72
4      P029  2024-11-02 17:04:16         3     1300.92  433.64
```

In [29]:
```
# Merging data on CustomerID
merged_df = pd.merge(customers_df, transactions_df, on='CustomerID')

# Feature engineering: Aggregate transaction features
transaction_features = merged_df.groupby('CustomerID').agg({
    'TotalValue': ['sum', 'mean', 'count'],  # Use 'TotalValue' instead of 'Transactio
}).reset_index()

# Displaying the aggregated features
print(transaction_features.head())
```

```
  CustomerID TotalValue
                    sum     mean count
0      C0001    3354.52  670.904     5
1      C0002    1862.74  465.685     4
2      C0003    2725.38  681.345     4
3      C0004    5354.88  669.360     8
4      C0005    2034.24  678.080     3
```

In [ ]:

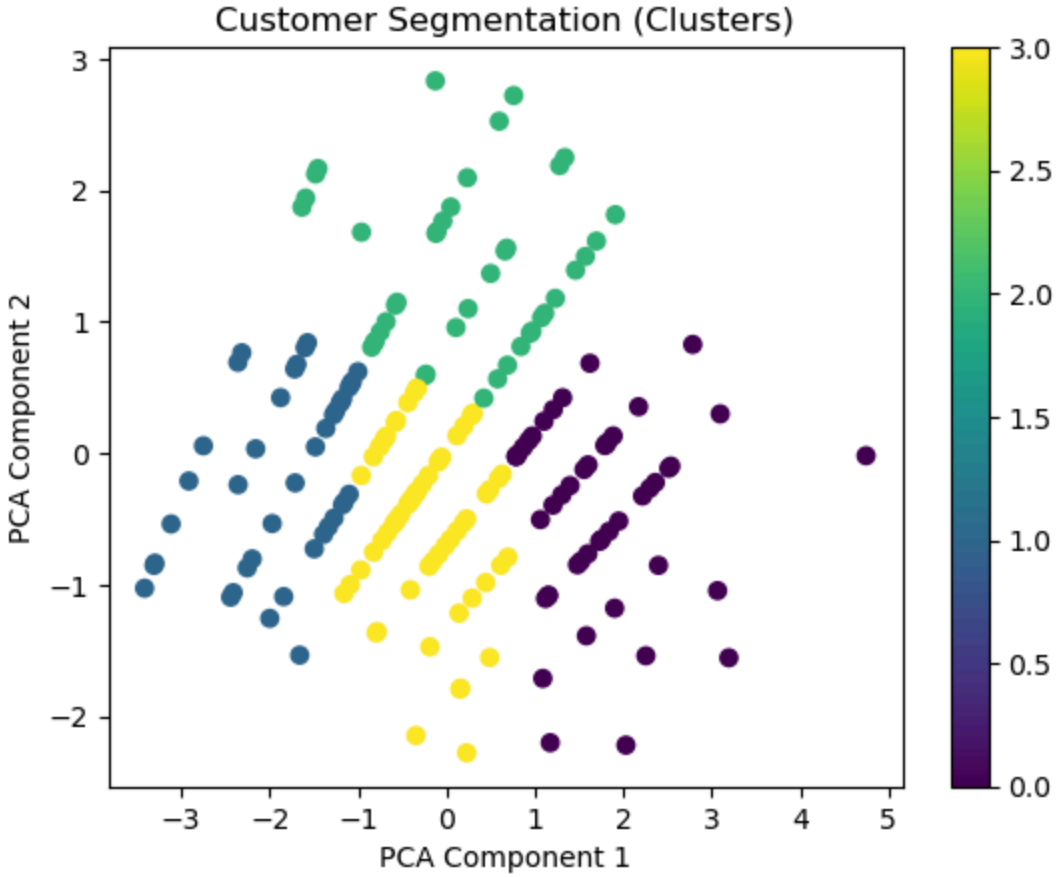
In [ ]:

In [ ]:

In [33]:
```
# Now normalize the features using the correct column names
scaler = StandardScaler()
transaction_features_scaled = scaler.fit_transform(transaction_features[['TotalValue_s

# Apply KMeans clustering (you can experiment with the number of clusters)
kmeans = KMeans(n_clusters=4, random_state=42)
transaction_features['Cluster'] = kmeans.fit_predict(transaction_features_scaled)

# Visualizing the clusters using PCA
pca = PCA(n_components=2)
pca_result = pca.fit_transform(transaction_features_scaled)

plt.scatter(pca_result[:, 0], pca_result[:, 1], c=transaction_features['Cluster'], cma
plt.title('Customer Segmentation (Clusters)')
plt.xlabel('PCA Component 1')
plt.ylabel('PCA Component 2')
```

```
plt.colorbar()
plt.show()
```

```
C:\Users\USER\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarn
ing: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the valu
e of `n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\USER\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarnin
g: KMeans is known to have a memory leak on Windows with MKL, when there are less chu
nks than available threads. You can avoid it by setting the environment variable OMP_
NUM_THREADS=1.
  warnings.warn(
```



In [35]:

```
# Step 1: Import necessary libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
from sklearn.cluster import KMeans
from sklearn.metrics import davies_bouldin_score, silhouette_score

# Step 2: Load the data
customers_df = pd.read_csv(r"C:\Users\USER\Desktop\Datasets\Customers.csv")
transactions_df = pd.read_csv(r"C:\Users\USER\Desktop\Datasets\Transactions.csv")


# Step 3: Feature Engineering (merging datasets)
# Merge the customers and transactions data on 'CustomerID'
merged_data = pd.merge(transactions, customers, on='CustomerID', how='inner')

# Create features from transaction data
```

```
transaction_summary = merged_data.groupby('CustomerID').agg(
    TotalValue_sum=('TotalValue', 'sum'),
    TotalValue_mean=('TotalValue', 'mean'),
    TotalValue_count=('TotalValue', 'count')
).reset_index()

# Merge transaction features with customer profile
final_data = pd.merge(customers, transaction_summary, on='CustomerID', how='inner')

# Step 4: Data Normalization
scaler = StandardScaler()
scaled_data = scaler.fit_transform(final_data[['TotalValue_sum', 'TotalValue_mean', 'T

# Step 5: KMeans Clustering
# Try different values of n_clusters (from 2 to 10)
best_db_index = float('inf')
best_n_clusters = 2
for n_clusters in range(2, 11):
    kmeans = KMeans(n_clusters=n_clusters, random_state=42)
    kmeans.fit(scaled_data)

    # Calculate the Davies-Bouldin index for each number of clusters
    db_index = davies_bouldin_score(scaled_data, kmeans.labels_)

    if db_index < best_db_index:
        best_db_index = db_index
        best_n_clusters = n_clusters

# Perform final clustering with the best number of clusters
kmeans = KMeans(n_clusters=best_n_clusters, random_state=42)
kmeans.fit(scaled_data)
final_clusters = kmeans.labels_

# Step 6: Cluster Evaluation Metrics
sil_score = silhouette_score(scaled_data, final_clusters)
print(f'Best number of clusters: {best_n_clusters}')
print(f'Davies-Bouldin Index: {best_db_index}')
print(f'Silhouette Score: {sil_score}')

# Step 7: Visualize Clusters (2D using PCA)
pca = PCA(n_components=2)
pca_data = pca.fit_transform(scaled_data)

plt.figure(figsize=(8, 6))
plt.scatter(pca_data[:, 0], pca_data[:, 1], c=final_clusters, cmap='viridis', alpha=0.
plt.title(f'Customer Segments (KMeans - {best_n_clusters} clusters)')
plt.xlabel('PCA Component 1')
plt.ylabel('PCA Component 2')
plt.colorbar(label='Cluster')
plt.show()
```

```
C:\Users\USER\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarn
ing: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the valu
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C:\Users\USER\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarnin
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NUM_THREADS=1.
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C:\Users\USER\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarn
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  super()._check_params_vs_input(X, default_n_init=10)
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```
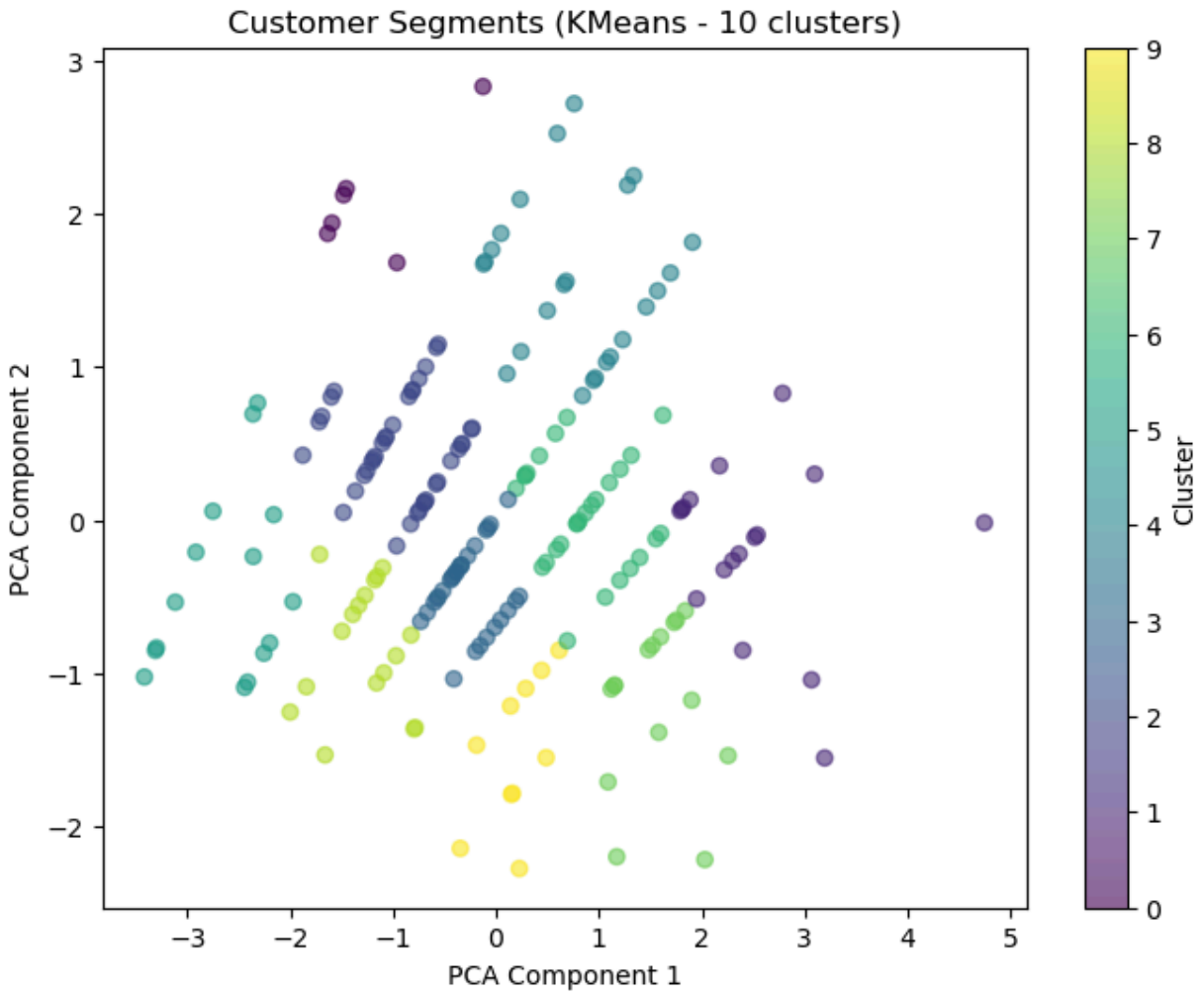

```
Best number of clusters: 10
Davies-Bouldin Index: 0.8079919837103067
Silhouette Score: 0.3551980191488424
```


Customer Segments (KMeans - 10 clusters)
PCA Component 2
PCA Component 1
Cluster
3
2
1
0
−1
−2
−3
−2
−1
0
1
2
3
4
5
9
8
7
6
5
4
3
2
1
0

In [ ]: