```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from google.colab import drive

# Mount Google Drive
drive.mount('/content/drive')

# Load the data
customer_data = pd.read_csv('/content/drive/MyDrive/Pythonclass/QVI_purchase_behaviour.csv')
transaction_data = pd.read_excel('/content/drive/MyDrive/Pythonclass/QVI_transaction_data.xlsx')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```python
# Display the first few rows of each dataset
print("Customer Data:")
print(customer_data.head())

print("\nTransaction Data:")
print(transaction_data.head())


```

```
Customer Data:
   LYLTY_CARD_NBR               LIFESTAGE PREMIUM_CUSTOMER
0            1000   YOUNG SINGLES/COUPLES          Premium
1            1002   YOUNG SINGLES/COUPLES       Mainstream
2            1003          YOUNG FAMILIES           Budget
3            1004   OLDER SINGLES/COUPLES       Mainstream
4            1005  MIDAGE SINGLES/COUPLES       Mainstream

Transaction Data:
    DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  \
0  43390          1            1000       1         5
1  43599          1            1307     348        66
2  43605          1            1343     383        61
3  43329          2            2373     974        69
4  43330          2            2426    1038       108

                                  PROD_NAME  PROD_QTY  TOT_SALES
0    Natural Chip        Compny SeaSalt175g         2        6.0
1                  CCs Nacho Cheese    175g         3        6.3
2    Smiths Crinkle Cut  Chips Chicken 170g         2        2.9
3    Smiths Chip Thinly  S/Cream&Onion 175g         5       15.0
4  Kettle Tortilla ChpsHny&Jlpno Chili 150g         3       13.8
```

```python
# High-level summary of customer data
print("\nCustomer Data Summary:")
print(customer_data.describe(include='all'))
print(customer_data.info())

```

```

Customer Data Summary:
        LYLTY_CARD_NBR LIFESTAGE PREMIUM_CUSTOMER
count     7.263700e+04     72637            72637
unique             NaN         7                3
top                NaN  RETIREES       Mainstream
freq               NaN     14805            29245
mean      1.361859e+05       NaN              NaN
std       8.989293e+04       NaN              NaN
min       1.000000e+03       NaN              NaN
25%       6.620200e+04       NaN              NaN
50%       1.340400e+05       NaN              NaN
75%       2.033750e+05       NaN              NaN
max       2.373711e+06       NaN              NaN
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 72637 entries, 0 to 72636
Data columns (total 3 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   LYLTY_CARD_NBR    72637 non-null  int64
 1   LIFESTAGE         72637 non-null  object
 2   PREMIUM_CUSTOMER  72637 non-null  object
dtypes: int64(1), object(2)
memory usage: 1.7+ MB
None
```

```
# High-level summary of transaction data
print("\nTransaction Data Summary:")
print(transaction_data.describe(include='all'))
print(transaction_data.info())

```

```

Transaction Data Summary:
                 DATE     STORE_NBR  LYLTY_CARD_NBR        TXN_ID  \
count   264836.000000  264836.00000    2.648360e+05  2.648360e+05   
unique            NaN           NaN             NaN           NaN   
top               NaN           NaN             NaN           NaN   
freq              NaN           NaN             NaN           NaN   
mean     43464.036260     135.08011    1.355495e+05  1.351583e+05   
std        105.389282      76.78418    8.057998e+04  7.813303e+04   
min      43282.000000       1.00000    1.000000e+03  1.000000e+00   
25%      43373.000000      70.00000    7.002100e+04  6.760150e+04   
50%      43464.000000     130.00000    1.303575e+05  1.351375e+05   
75%      43555.000000     203.00000    2.030942e+05  2.027012e+05   
max      43646.000000     272.00000    2.373711e+06  2.415841e+06   

             PROD_NBR                                 PROD_NAME       PROD_QTY  \
count   264836.000000                                    264836  264836.000000   
unique            NaN                                       114            NaN   
top               NaN  Kettle Mozzarella   Basil & Pesto 175g            NaN   
freq              NaN                                      3304            NaN   
mean        56.583157                                       NaN       1.907309   
std         32.826638                                       NaN       0.643654   
min          1.000000                                       NaN       1.000000   
25%         28.000000                                       NaN       2.000000   
50%         56.000000                                       NaN       2.000000   
75%         85.000000                                       NaN       2.000000   
max        114.000000                                       NaN     200.000000   

            TOT_SALES  
count   264836.000000  
unique            NaN  
top               NaN  
freq              NaN  
mean         7.304200  
std          3.083226  
min          1.500000  
25%          5.400000  
50%          7.400000  
75%          9.200000  
max        650.000000  
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 264836 entries, 0 to 264835
Data columns (total 8 columns):
 #   Column          Non-Null Count   Dtype  
---  ------          --------------   -----  
 0   DATE            264836 non-null  int64  
 1   STORE_NBR       264836 non-null  int64  
 2   LYLTY_CARD_NBR  264836 non-null  int64  
 3   TXN_ID          264836 non-null  int64  
 4   PROD_NBR        264836 non-null  int64  
 5   PROD_NAME       264836 non-null  object 
 6   PROD_QTY        264836 non-null  int64  
 7   TOT_SALES       264836 non-null  float64
dtypes: float64(1), int64(6), object(1)
memory usage: 16.2+ MB
None
```

```
# Check for missing values
print("\nMissing Values in Customer Data:")
print(customer_data.isnull().sum())

print("\nMissing Values in Transaction Data:")
print(transaction_data.isnull().sum())

```

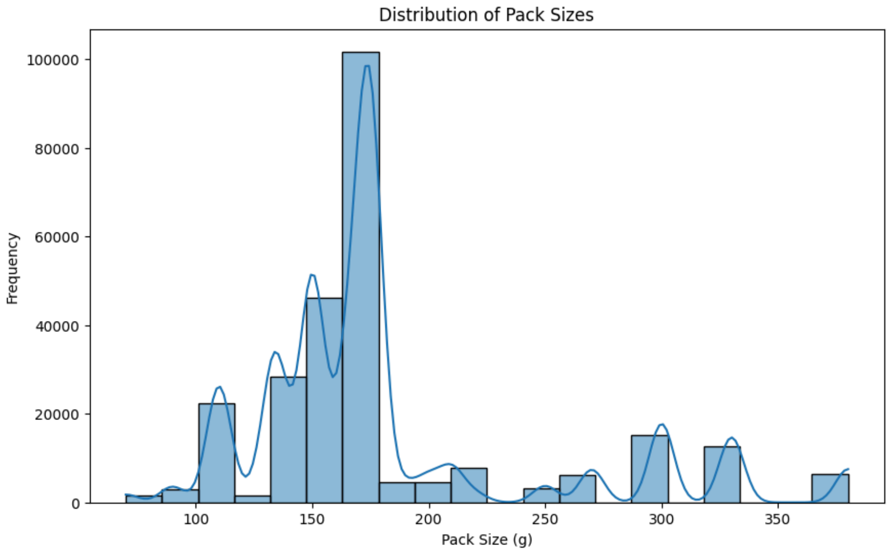
```

Missing Values in Customer Data:
LYLTY_CARD_NBR      0
LIFESTAGE           0
PREMIUM_CUSTOMER    0
dtype: int64

Missing Values in Transaction Data:
DATE              0
STORE_NBR         0
```

```
LYLTY_CARD_NBR    0
TXN_ID            0
PROD_NBR          0
PROD_NAME         0
PROD_QTY          0
TOT_SALES         0
dtype: int64
```

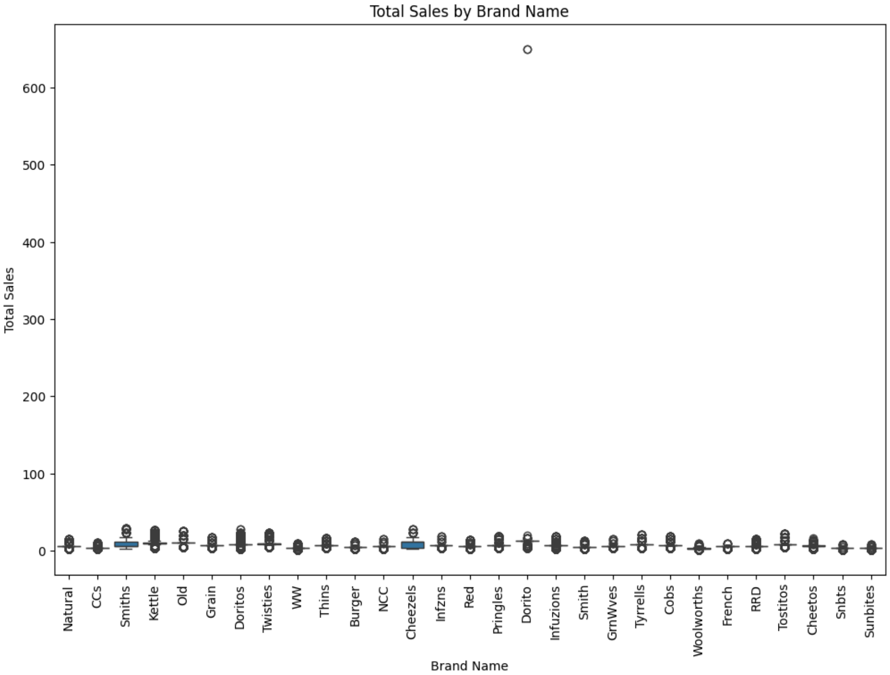
```
# Check for duplicates
print("\nDuplicate Rows in Customer Data:")
print(customer_data.duplicated().sum())

print("\nDuplicate Rows in Transaction Data:")
print(transaction_data.duplicated().sum())

```

```

Duplicate Rows in Customer Data:
0

Duplicate Rows in Transaction Data:
1
```

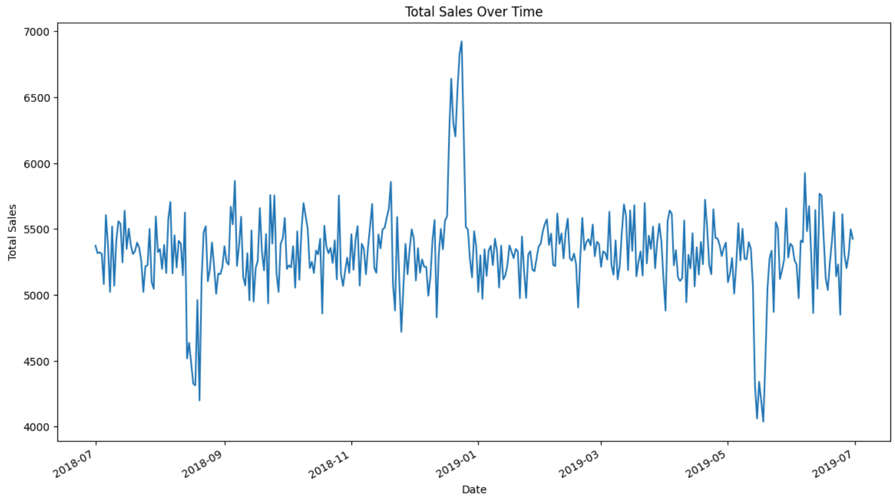
```
# Drop duplicate rows in transaction data
transaction_data = transaction_data.drop_duplicates()

# Derive new features
# Extract pack size from product name and convert to float
transaction_data['pack_size'] = transaction_data['PROD_NAME'].str.extract('(\d+)').astype(float)

# Extract brand name from product name
transaction_data['brand_name'] = transaction_data['PROD_NAME'].str.extract('([A-Za-z]+)')

# Convert DATE to datetime
transaction_data['DATE'] = pd.to_datetime(transaction_data['DATE'], origin='1899-12-30', unit='D')

# Descriptive analysis
plt.figure(figsize=(10, 6))
sns.histplot(transaction_data['pack_size'], bins=20, kde=True)
plt.title('Distribution of Pack Sizes')
plt.xlabel('Pack Size (g)')
plt.ylabel('Frequency')
plt.show()

```



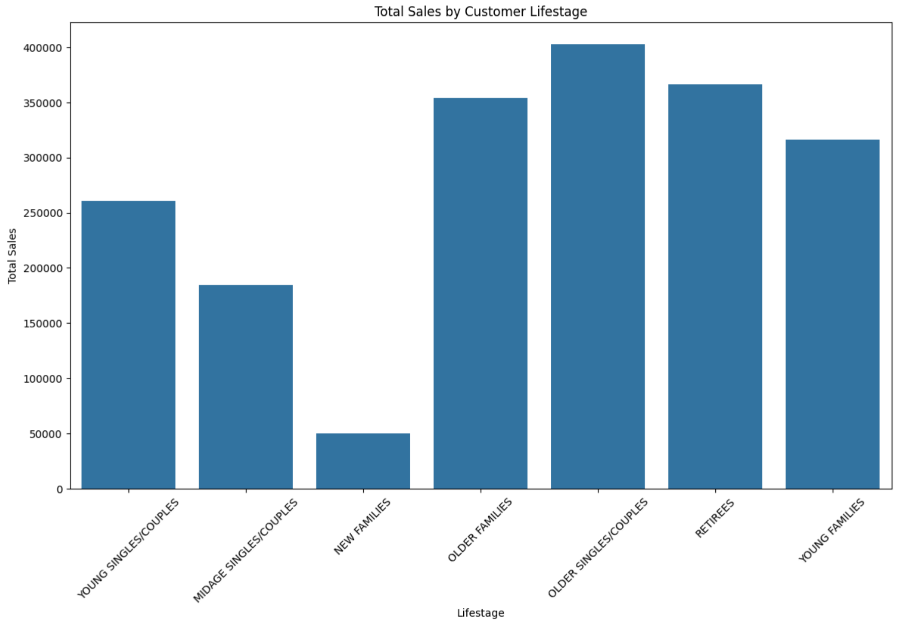
```
plt.figure(figsize=(12, 8))
sns.boxplot(x='brand_name', y='TOT_SALES', data=transaction_data)
plt.title('Total Sales by Brand Name')
plt.xlabel('Brand Name')
plt.ylabel('Total Sales')
plt.xticks(rotation=90)
plt.show()

```



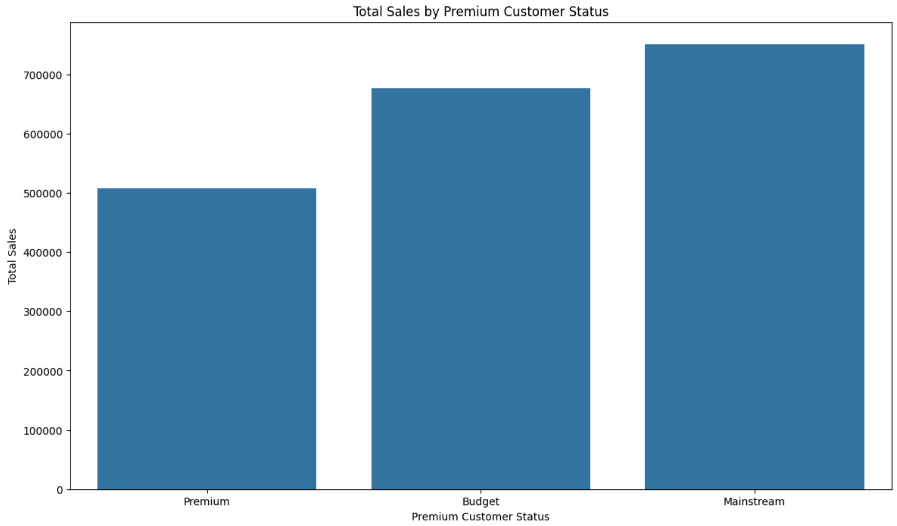
```
# Sales over time
plt.figure(figsize=(14, 8))
transaction_data.groupby('DATE')['TOT_SALES'].sum().plot()
plt.title('Total Sales Over Time')
plt.xlabel('Date')
plt.ylabel('Total Sales')
plt.show()




```



```python
# Merge customer and transaction data
merged_data = pd.merge(transaction_data, customer_data, how='left', on='LYLTY_CARD_NBR')

# Sales by Lifestage
plt.figure(figsize=(14, 8))
sns.barplot(x='LIFESTAGE', y='TOT_SALES', data=merged_data, estimator=sum, errorbar=None)
plt.title('Total Sales by Customer Lifestage')
plt.xlabel('Lifestage')
plt.ylabel('Total Sales')
plt.xticks(rotation=45)
plt.show()
```

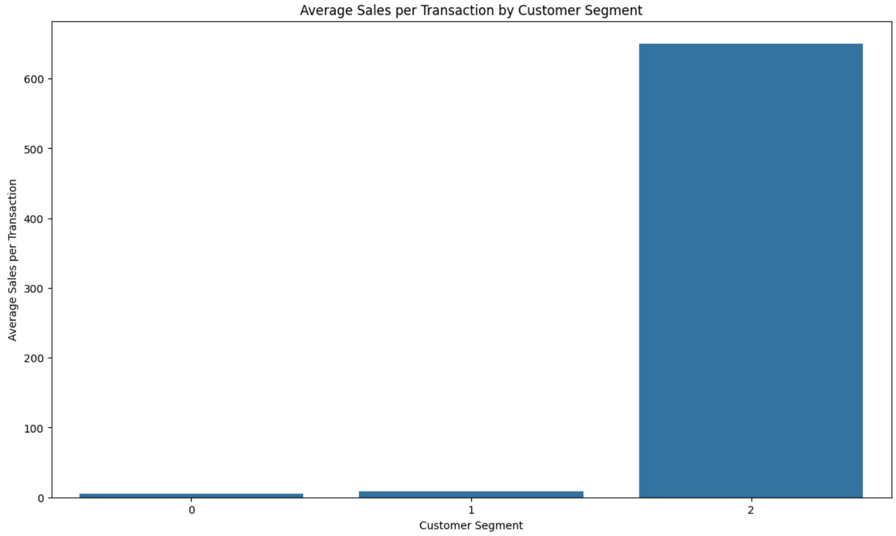


```

# Sales by Premium Customer Status
plt.figure(figsize=(14, 8))
sns.barplot(x='PREMIUM_CUSTOMER', y='TOT_SALES', data=merged_data, estimator=sum, errorbar=None)
plt.title('Total Sales by Premium Customer Status')
plt.xlabel('Premium Customer Status')
plt.ylabel('Total Sales')
plt.show()

```

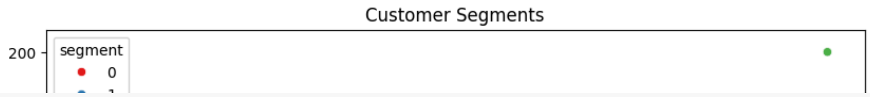


```python
# Customer segmentation using K-means clustering
from sklearn.cluster import KMeans

# Selecting features for clustering
features = merged_data[['TOT_SALES', 'PROD_QTY']]
kmeans = KMeans(n_clusters=3, random_state=123)
merged_data['segment'] = kmeans.fit_predict(features)

# Average Sales per Transaction by Customer Segment
plt.figure(figsize=(14, 8))
sns.barplot(x='segment', y='TOT_SALES', data=merged_data, estimator=np.mean, errorbar=None)
plt.title('Average Sales per Transaction by Customer Segment')
plt.xlabel('Customer Segment')
plt.ylabel('Average Sales per Transaction')
plt.show()


```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: T
  warnings.warn(
```



```
# Visualize segments
plt.figure(figsize=(10, 6))
sns.scatterplot(x='TOT_SALES', y='PROD_QTY', hue='segment', data=merged_data, palette='Set1')
plt.title('Customer Segments')
plt.xlabel('Total Sales')
plt.ylabel('Product Quantity')
plt.show()


```



```
# Save results to PDF
import matplotlib.backends.backend_pdf

pdf = matplotlib.backends.backend_pdf.PdfPages("/content/drive/MyDrive/Pythonclass/analysis_results.pdf")
```