01_data_cleaning

May 25, 2025

[2]:
```
import pandas as pd


purchase_df = pd.read_csv('../data/QVI_purchase_behaviour.csv')
transaction_df = pd.read_excel('../data/QVI_transaction_data.xlsx',␣
 ↪sheet_name='in')
```

[ ]:
```
# Converting 'DATE' column from Excel serial to datetime
transaction_df['DATE'] = pd.to_datetime(transaction_df['DATE'],␣
 ↪origin='1899-12-30', unit='D')

# Basic checks
print("Date Range:", transaction_df['DATE'].min(), "to", transaction_df['DATE'].
 ↪max())
print("Missing Values:\n", transaction_df.isnull().sum())
```

```
Date Range: 2018-07-01 00:00:00 to 2019-06-30 00:00:00
Missing Values:
 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
```

[4]:
```
import numpy as np

# Extracting Pack Size
transaction_df['PACK_SIZE'] = transaction_df['PROD_NAME'].str.
 ↪extract(r'(\d+)g').astype(float)

# Extracting Brand
transaction_df['BRAND'] = transaction_df['PROD_NAME'].str.split().str[0]

# Quick summary
```

```
print(transaction_df[['PROD_NAME', 'PACK_SIZE', 'BRAND']].head())

# Check
print("Missing PACK_SIZE values:", transaction_df['PACK_SIZE'].isna().sum())
```

```
                                  PROD_NAME  PACK_SIZE    BRAND
0    Natural Chip        Compny SeaSalt175g      175.0  Natural
1                  CCs Nacho Cheese    175g      175.0      CCs
2    Smiths Crinkle Cut  Chips Chicken 170g      170.0   Smiths
3    Smiths Chip Thinly  S/Cream&Onion 175g      175.0   Smiths
4  Kettle Tortilla ChpsHny&Jlpno Chili 150g      150.0   Kettle
Missing PACK_SIZE values: 6064
```

[5]:
```
# Show rows with missing PACK_SIZE
missing_pack = transaction_df[transaction_df['PACK_SIZE'].isna()]
print(missing_pack[['PROD_NAME']].head(10))
```

```
                                    PROD_NAME
9       Grain Waves Sour    Cream&Chives 210G
34    Red Rock Deli Sp    Salt & Truffle 150G
35   Smiths Thinly       Swt Chli&S/Cream175G
212   Red Rock Deli Sp    Salt & Truffle 150G
292     Grain Waves Sour    Cream&Chives 210G
331   Red Rock Deli Sp    Salt & Truffle 150G
421  Smiths Thinly       Swt Chli&S/Cream175G
423     Grain Waves Sour    Cream&Chives 210G
428  Smiths Thinly       Swt Chli&S/Cream175G
465   Red Rock Deli Sp    Salt & Truffle 150G
```

[6]:
```
# Update PACK_SIZE extraction to include both 'g' and 'G'
transaction_df['PACK_SIZE'] = transaction_df['PROD_NAME'].str.
  ↪extract(r'(\d+)[gG]').astype(float)

# Re-check missing values
print("Missing PACK_SIZE values after fix:", transaction_df['PACK_SIZE'].isna().
  ↪sum())
```

```
Missing PACK_SIZE values after fix: 0
```

[7]:
```
duplicates = transaction_df.duplicated().sum()
print(f"Duplicate rows: {duplicates}")


print(transaction_df['PROD_QTY'].describe())

# View extreme values
print(transaction_df[transaction_df['PROD_QTY'] > 5].sort_values(by='PROD_QTY',␣
  ↪ascending=False).head(10))
```

```
Duplicate rows: 1
count    264836.000000
mean          1.907309
std           0.643654
min           1.000000
25%           2.000000
50%           2.000000
75%           2.000000
max         200.000000
Name: PROD_QTY, dtype: float64
            DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  \
69762 2018-08-19        226          226000  226201         4
69763 2019-05-20        226          226000  226210         4

                                PROD_NAME  PROD_QTY  TOT_SALES  PACK_SIZE  \
69762  Dorito Corn Chp     Supreme 380g       200      650.0      380.0
69763  Dorito Corn Chp     Supreme 380g       200      650.0      380.0

        BRAND
69762  Dorito
69763  Dorito
```

[8]:
```python
# Drop duplicate row
transaction_df.drop_duplicates(inplace=True)

# Filter out unrealistic bulk buys (e.g., anything over 5 units of chips)
transaction_df = transaction_df[transaction_df['PROD_QTY'] <= 5]

# Confirm cleanup
print("Remaining rows after cleaning:", len(transaction_df))
```

```
Remaining rows after cleaning: 264833
```

[10]:
```python
customer_df = pd.read_csv('../data/QVI_purchase_behaviour.csv')
```

[12]:
```python
import pandas as pd


customer_df = pd.read_csv('../data/QVI_purchase_behaviour.csv')

# Preview the data
print("Customer Data Preview:")
print(customer_df.head())

# Check for missing values
print("\nMissing values in customer data:")
print(customer_df.isnull().sum())
```

```
Customer Data Preview:
   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

Missing values in customer data:
LYLTY_CARD_NBR      0
LIFESTAGE           0
PREMIUM_CUSTOMER    0
dtype: int64
```

[13]:
```
merged_df = pd.merge(transaction_df, customer_df, on='LYLTY_CARD_NBR',␣
 ↪how='inner')

# Quick check
print("Merged Data Preview:")
print(merged_df.head())

# Shape and null check
print("\nShape of merged data:", merged_df.shape)
print("Missing values after merge:")
print(merged_df.isnull().sum())
```

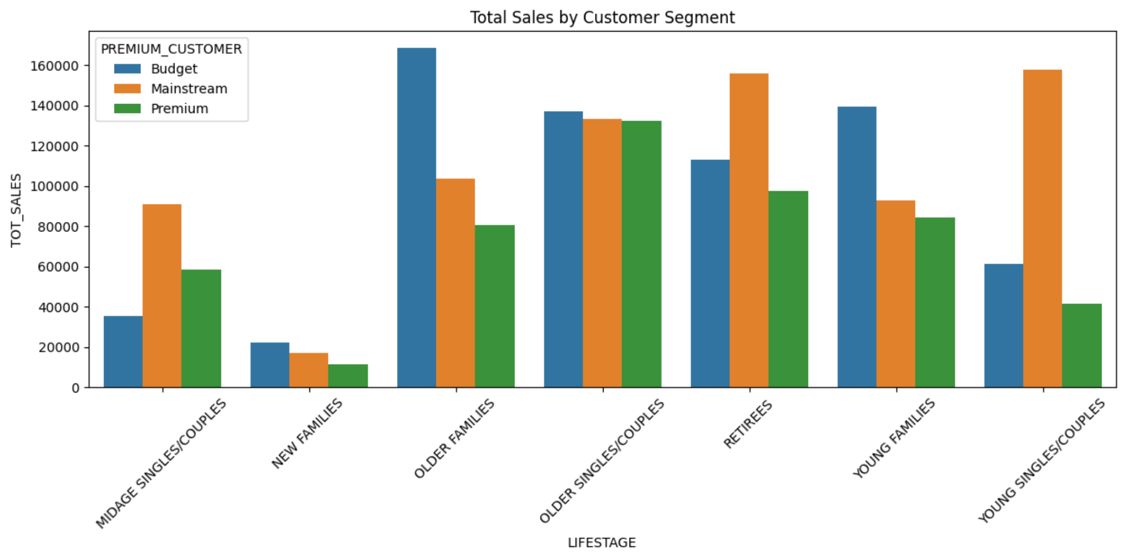
```
Merged Data Preview:
        DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  \
0 2018-10-17          1            1000       1         5
1 2019-05-14          1            1307     348        66
2 2019-05-20          1            1343     383        61
3 2018-08-17          2            2373     974        69
4 2018-08-18          2            2426    1038       108

                                  PROD_NAME  PROD_QTY  TOT_SALES  PACK_SIZE  \
0    Natural Chip        Compny SeaSalt175g         2        6.0      175.0
1                  CCs Nacho Cheese    175g         3        6.3      175.0
2    Smiths Crinkle Cut  Chips Chicken 170g         2        2.9      170.0
3    Smiths Chip Thinly  S/Cream&Onion 175g         5       15.0      175.0
4  Kettle Tortilla ChpsHny&Jlpno Chili 150g         3       13.8      150.0

     BRAND               LIFESTAGE PREMIUM_CUSTOMER
0  Natural   YOUNG SINGLES/COUPLES          Premium
1      CCs  MIDAGE SINGLES/COUPLES           Budget
2   Smiths  MIDAGE SINGLES/COUPLES           Budget
3   Smiths  MIDAGE SINGLES/COUPLES           Budget
4   Kettle  MIDAGE SINGLES/COUPLES           Budget

Shape of merged data: (264833, 12)
```

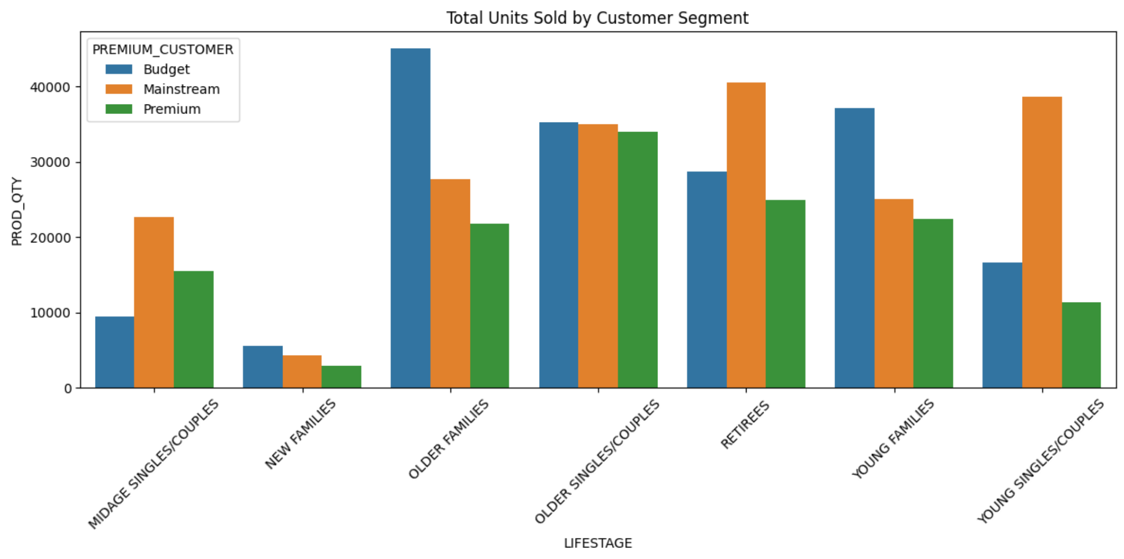
```
Missing values after merge:
DATE                0
STORE_NBR           0
LYLTY_CARD_NBR      0
TXN_ID              0
PROD_NBR            0
PROD_NAME           0
PROD_QTY            0
TOT_SALES           0
PACK_SIZE           0
BRAND               0
LIFESTAGE           0
PREMIUM_CUSTOMER    0
dtype: int64
```

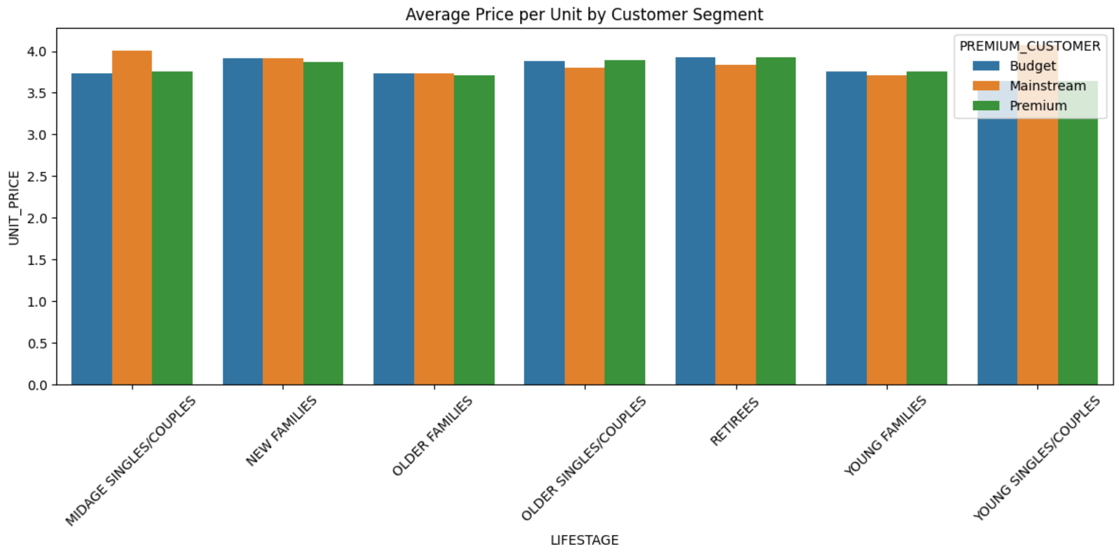
[14]:

```python
import matplotlib.pyplot as plt
import seaborn as sns

# Total sales by LIFESTAGE and PREMIUM_CUSTOMER
sales_by_segment = merged_df.groupby(['LIFESTAGE',␣
 ↪'PREMIUM_CUSTOMER'])['TOT_SALES'].sum().reset_index()

plt.figure(figsize=(12,6))
sns.barplot(data=sales_by_segment, x='LIFESTAGE', y='TOT_SALES',␣
 ↪hue='PREMIUM_CUSTOMER')
plt.title('Total Sales by Customer Segment')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()

# Units sold by segment
units_by_segment = merged_df.groupby(['LIFESTAGE',␣
 ↪'PREMIUM_CUSTOMER'])['PROD_QTY'].sum().reset_index()

plt.figure(figsize=(12,6))
sns.barplot(data=units_by_segment, x='LIFESTAGE', y='PROD_QTY',␣
 ↪hue='PREMIUM_CUSTOMER')
plt.title('Total Units Sold by Customer Segment')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()

# Average price per unit by segment
merged_df['UNIT_PRICE'] = merged_df['TOT_SALES'] / merged_df['PROD_QTY']
avg_price_by_segment = merged_df.groupby(['LIFESTAGE',␣
 ↪'PREMIUM_CUSTOMER'])['UNIT_PRICE'].mean().reset_index()
```

```
plt.figure(figsize=(12,6))
sns.barplot(data=avg_price_by_segment, x='LIFESTAGE', y='UNIT_PRICE',␣
↪hue='PREMIUM_CUSTOMER')
plt.title('Average Price per Unit by Customer Segment')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```







[16]:
```
merged_df.info()
```

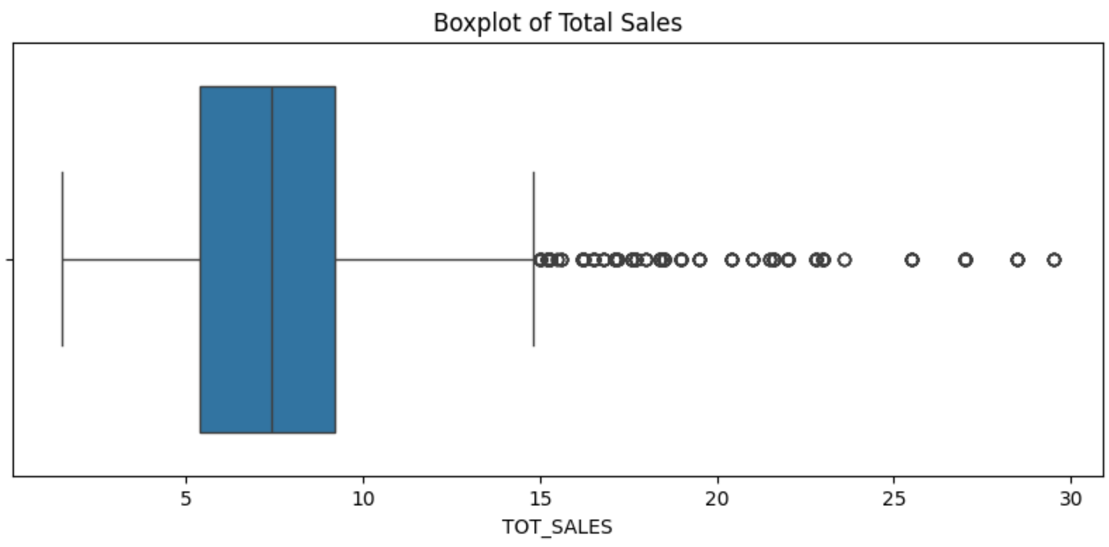
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 264833 entries, 0 to 264832
Data columns (total 13 columns):
 #   Column            Non-Null Count   Dtype
---  ------            --------------   -----
 0   DATE              264833 non-null  datetime64[ns]
 1   STORE_NBR         264833 non-null  int64
 2   LYLTY_CARD_NBR    264833 non-null  int64
 3   TXN_ID            264833 non-null  int64
 4   PROD_NBR          264833 non-null  int64
 5   PROD_NAME         264833 non-null  object
 6   PROD_QTY          264833 non-null  int64
 7   TOT_SALES         264833 non-null  float64
 8   PACK_SIZE         264833 non-null  float64
 9   BRAND             264833 non-null  object
 10  LIFESTAGE         264833 non-null  object
 11  PREMIUM_CUSTOMER  264833 non-null  object
 12  UNIT_PRICE        264833 non-null  float64
dtypes: datetime64[ns](1), float64(3), int64(5), object(4)
memory usage: 26.3+ MB
```

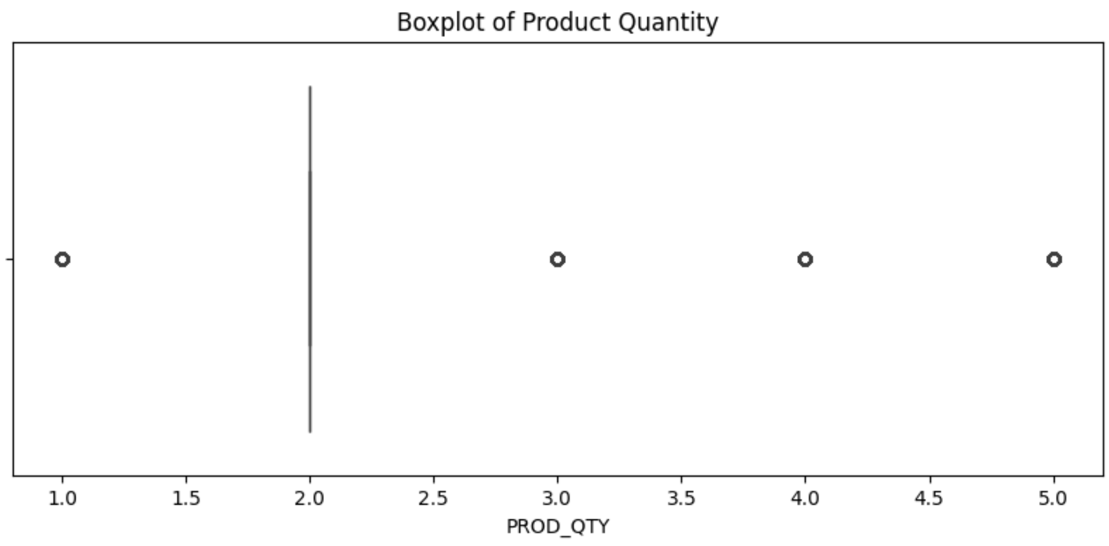
[17]:
```
merged_df.describe()
```

[17]:
```
                                DATE      STORE_NBR  LYLTY_CARD_NBR  \
count                         264833  264833.000000    2.648330e+05
mean   2018-12-30 00:52:39.666657792     135.079529    1.355489e+05
min              2018-07-01 00:00:00       1.000000    1.000000e+03
```

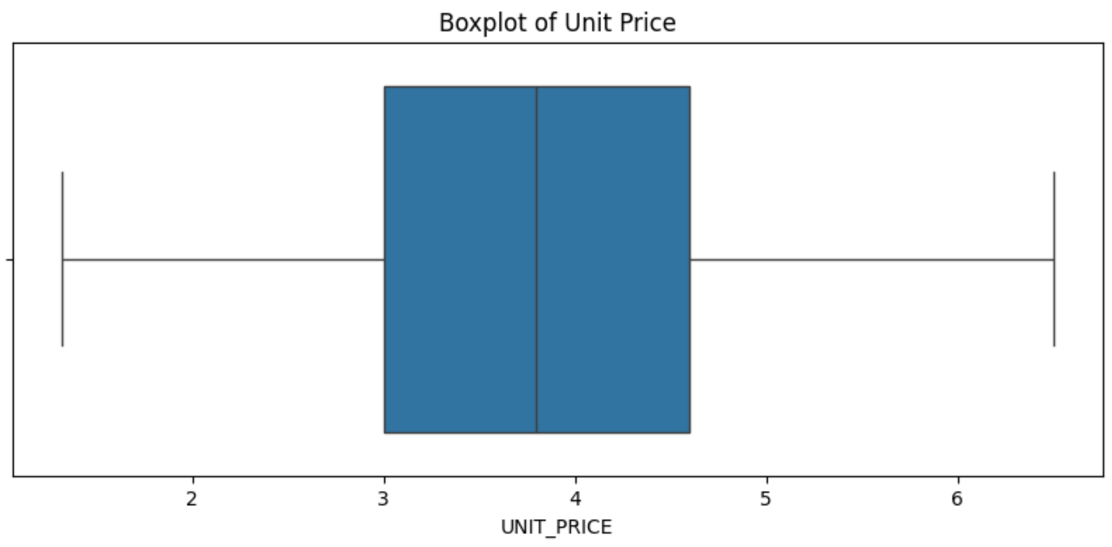
```
25%              2018-09-30 00:00:00      70.000000    7.002100e+04
50%              2018-12-30 00:00:00     130.000000    1.303570e+05
75%              2019-03-31 00:00:00     203.000000    2.030940e+05
max              2019-06-30 00:00:00     272.000000    2.373711e+06
std                              NaN      76.784189    8.058003e+04

             TXN_ID       PROD_NBR       PROD_QTY      TOT_SALES  \
count  2.648330e+05  264833.000000  264833.000000  264833.000000
mean   1.351577e+05      56.583598       1.905812       7.299351
min    1.000000e+00       1.000000       1.000000       1.500000
25%    6.760000e+04      28.000000       2.000000       5.400000
50%    1.351370e+05      56.000000       2.000000       7.400000
75%    2.027000e+05      85.000000       2.000000       9.200000
max    2.415841e+06     114.000000       5.000000      29.500000
std    7.813305e+04      32.826498       0.343437       2.527244

           PACK_SIZE     UNIT_PRICE
count  264833.000000  264833.000000
mean      182.425540       3.824632
min        70.000000       1.320000
25%       150.000000       3.000000
50%       170.000000       3.800000
75%       175.000000       4.600000
max       380.000000       6.500000
std        64.325268       1.109527
```

[19]:
```python
import seaborn as sns
import matplotlib.pyplot as plt

plt.figure(figsize=(10, 4))
sns.boxplot(x=merged_df['TOT_SALES'])
plt.title('Boxplot of Total Sales')
plt.show()

plt.figure(figsize=(10, 4))
sns.boxplot(x=merged_df['PROD_QTY'])
plt.title('Boxplot of Product Quantity')
plt.show()
```





[20]:
```
plt.figure(figsize=(10, 4))
sns.boxplot(x=merged_df['UNIT_PRICE'])
plt.title('Boxplot of Unit Price')
plt.show()
```

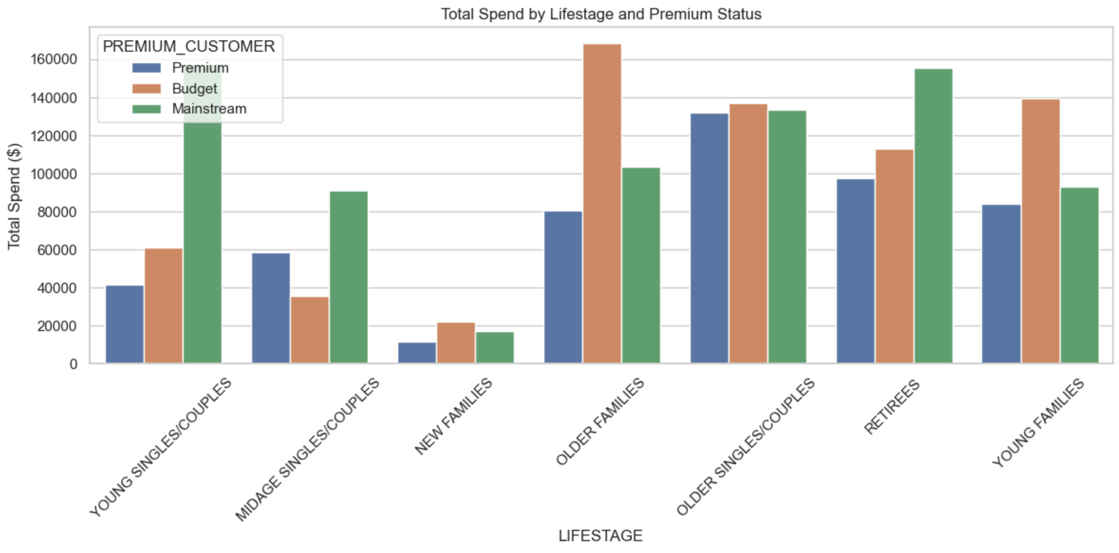


```
[21]: # Check high quantity purchases
      merged_df['PROD_QTY'].value_counts().sort_index(ascending=False).head(10)
```

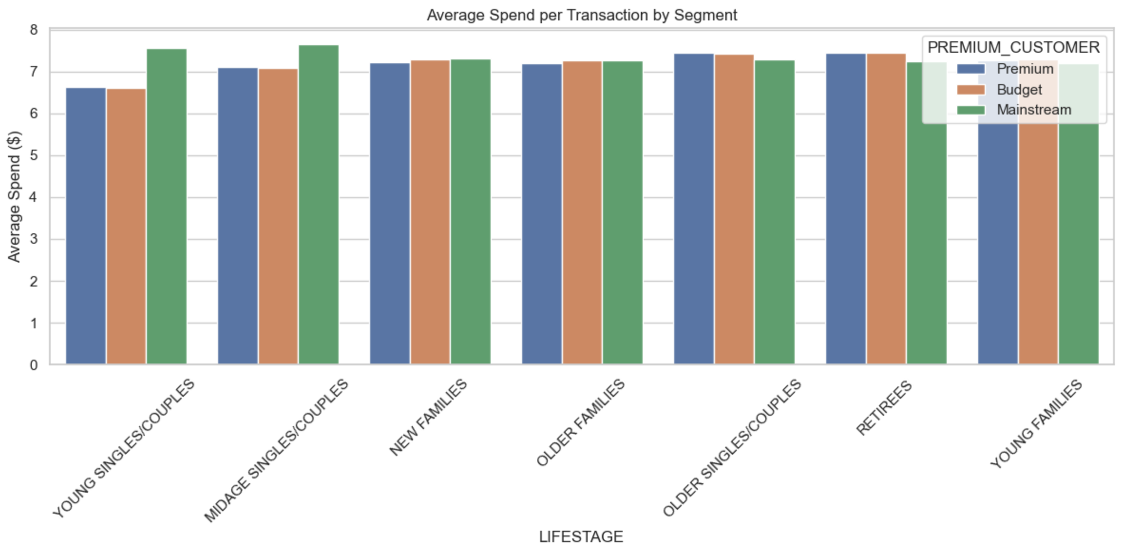
```
[21]: PROD_QTY
      5        450
      4        397
      3        430
      2     236038
      1      27518
      Name: count, dtype: int64
```

```
[22]: import matplotlib.pyplot as plt
      import seaborn as sns

      # Set plot style
      sns.set(style="whitegrid")

      # Grouped spend by LIFESTAGE and PREMIUM_CUSTOMER
      plt.figure(figsize=(12, 6))
      sns.barplot(data=merged_df,
                  x='LIFESTAGE',
                  y='TOT_SALES',
                  hue='PREMIUM_CUSTOMER',
                  estimator=sum,
                  ci=None)
      plt.title('Total Spend by Lifestage and Premium Status')
      plt.xticks(rotation=45)
      plt.ylabel('Total Spend ($)')
      plt.tight_layout()
plt.show()
```

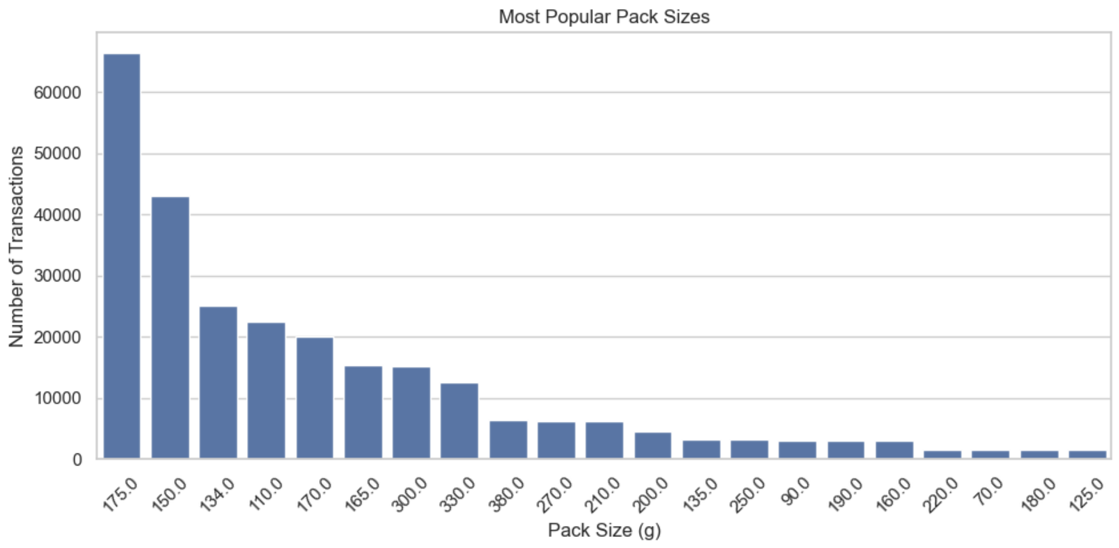
```
C:\Users\Arnav\AppData\Local\Temp\ipykernel_5852\3628436135.py:9: FutureWarning:

The `ci` parameter is deprecated. Use `errorbar=None` for the same effect.

  sns.barplot(data=merged_df,
```



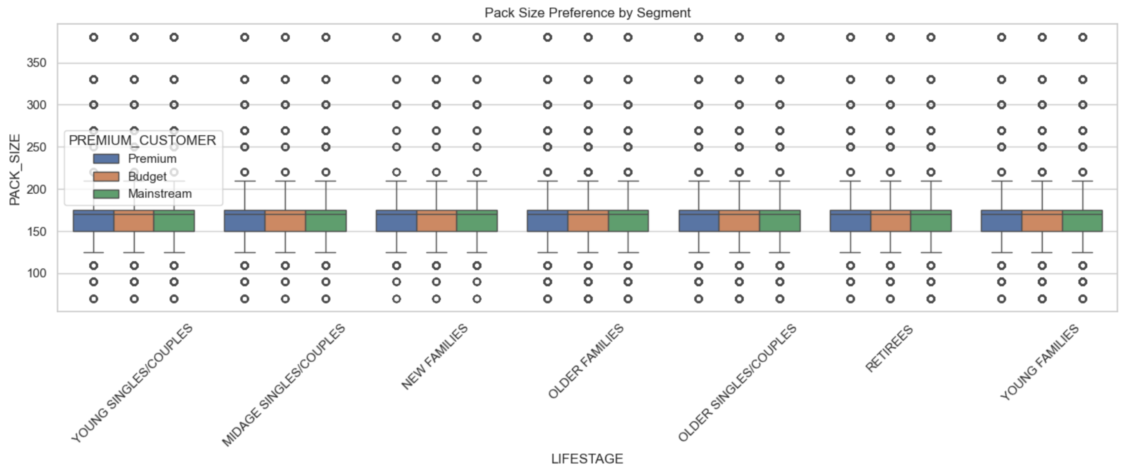
[23]:
```
# Average spend by segment
plt.figure(figsize=(12, 6))
sns.barplot(data=merged_df,
            x='LIFESTAGE',
            y='TOT_SALES',
            hue='PREMIUM_CUSTOMER',
            estimator='mean',
            errorbar=None)
plt.title('Average Spend per Transaction by Segment')
plt.xticks(rotation=45)
plt.ylabel('Average Spend ($)')
plt.tight_layout()
plt.show()
```



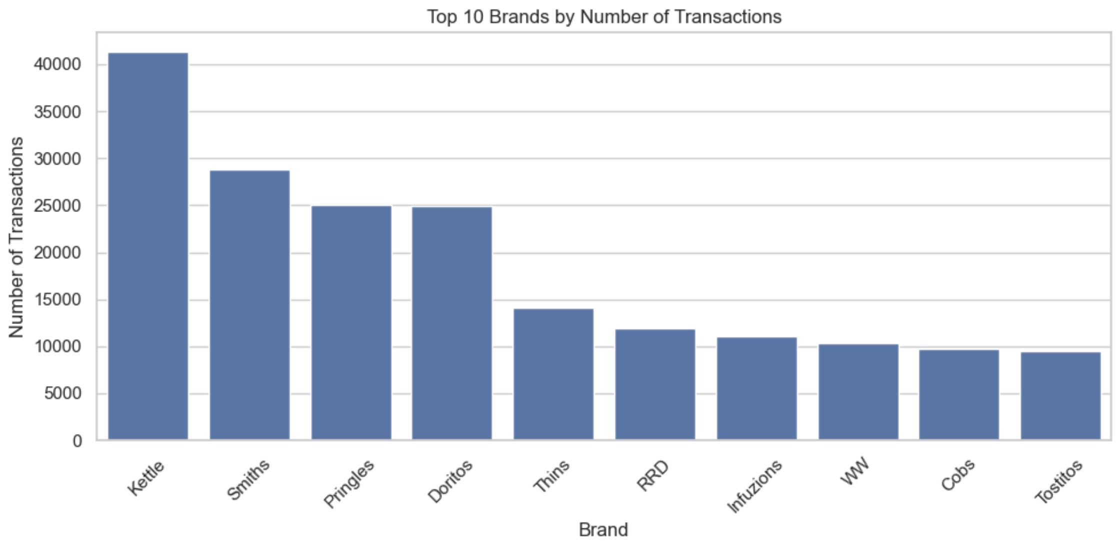
[24]:
```
plt.figure(figsize=(10, 5))
sns.countplot(data=merged_df, x='PACK_SIZE', order=merged_df['PACK_SIZE'].
  ↪value_counts().index)
plt.title('Most Popular Pack Sizes')
plt.xticks(rotation=45)
plt.xlabel('Pack Size (g)')
plt.ylabel('Number of Transactions')
plt.tight_layout()
plt.show()
```



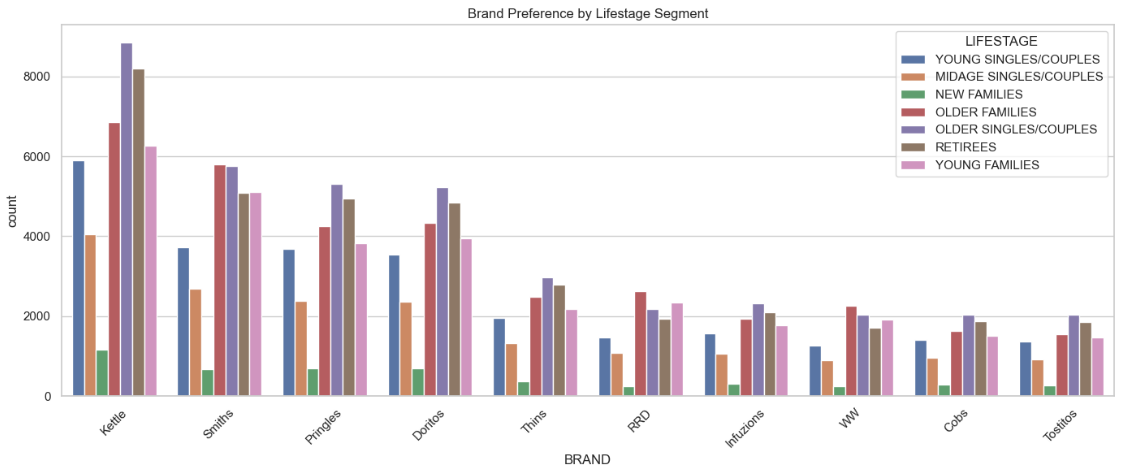
[25]:
```
plt.figure(figsize=(14, 6))
sns.boxplot(data=merged_df, x='LIFESTAGE', y='PACK_SIZE',␣
  ↪hue='PREMIUM_CUSTOMER')
plt.title('Pack Size Preference by Segment')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```

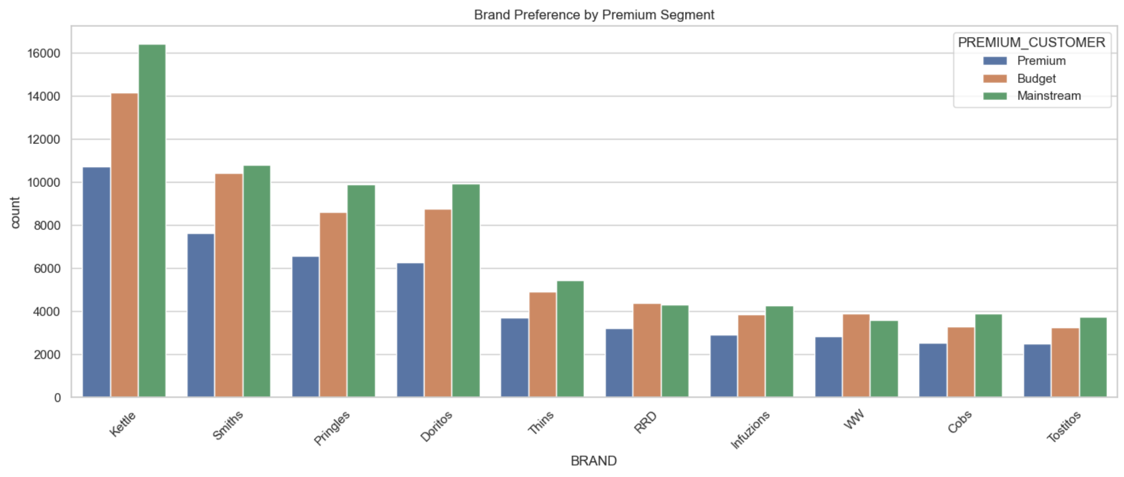


[26]:
```
top_brands = merged_df['BRAND'].value_counts().head(10)

plt.figure(figsize=(10, 5))
sns.barplot(x=top_brands.index, y=top_brands.values)
plt.title('Top 10 Brands by Number of Transactions')
plt.ylabel('Number of Transactions')
plt.xlabel('Brand')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```

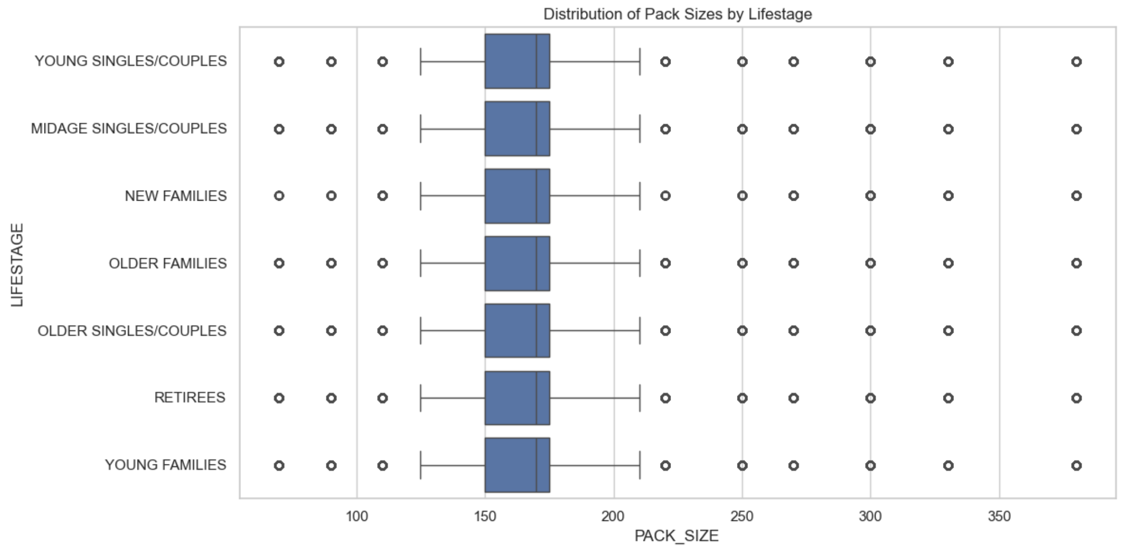


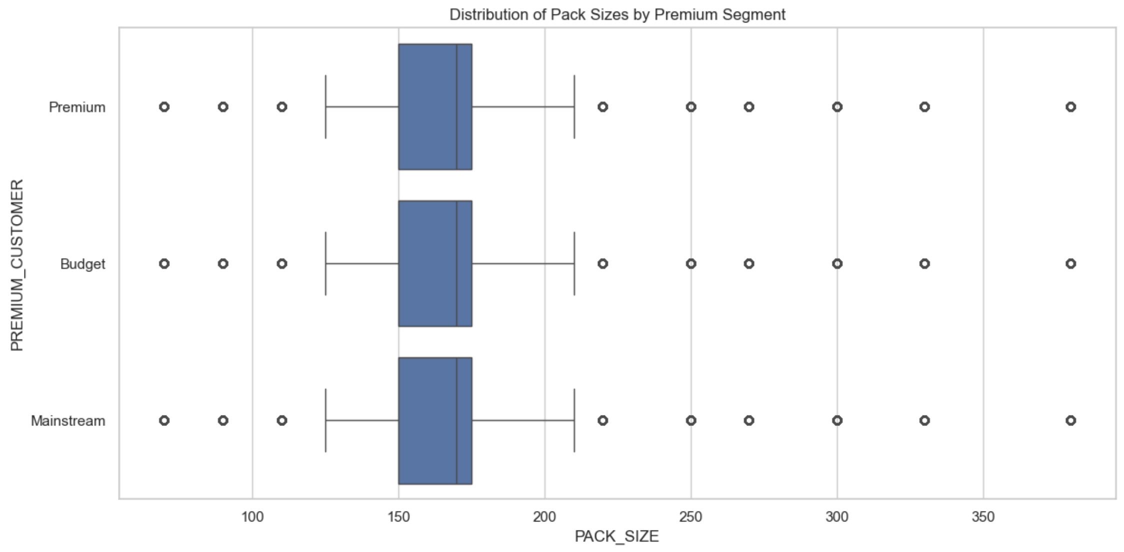
[27]:
```
plt.figure(figsize=(14, 6))
sns.countplot(data=merged_df, x='BRAND', hue='LIFESTAGE', order=top_brands.
 ↪index)
plt.title('Brand Preference by Lifestage Segment')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
plt.figure(figsize=(14, 6))
sns.countplot(data=merged_df, x='BRAND', hue='PREMIUM_CUSTOMER',␣
 ↪order=top_brands.index)
plt.title('Brand Preference by Premium Segment')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```





```
[28]: plt.figure(figsize=(12, 6))
      sns.boxplot(data=merged_df, x='PACK_SIZE', y='LIFESTAGE')
      plt.title('Distribution of Pack Sizes by Lifestage')
      plt.tight_layout()
      plt.show()
      plt.figure(figsize=(12, 6))
      sns.boxplot(data=merged_df, x='PACK_SIZE', y='PREMIUM_CUSTOMER')
      plt.title('Distribution of Pack Sizes by Premium Segment')
      plt.tight_layout()
      plt.show()
```




Distribution of Pack Sizes by Premium Segment
PREMIUM_CUSTOMER
Premium
Budget
Mainstream
100
150
200
250
300
350
PACK_SIZE

```
[ ]:
```