Task One: Data preparation and customer analytics

Conducting analysis on client's transaction dataset and identifying customer purchasing behaviours to generate insights and provide commercial recommendations.

Data Dictionary

- **DATE:** The date transaction was made
- **CLEANED_DATE:** The cleaner date version
- **STORE_NBR:** The store number
- **LYLTY_CARD_NBR:** Loyalty card number
- **TXN_ID:** Tax number ID
- **PROD_NBR:** Product number ID
- **PROD_NAME:** Product name
- **PROD_QTY:** Product quantity
- **TOT_SALES:** Total sales
- **LIFESTAGE:** Customer demography type of family setting
- **PREMIUM_CUSTOMER:** Type of customer value (Premium, Mainstream, Budget)

Understanding and cleaning transaction and customer data.

Transaction Data

```
# Importing necessary libraries

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import plotly_express as px
import plotly.graph_objects as go
import plotly.io as pio
import openpyxl
```

```
# Uploading the transaction data as df
# Data is directly connected to goodgle drive from google colab console
df = pd.read_excel('/content/drive/MyDrive/Analytical Engineering /Portfolio/QVI_transaction_data.xlsx', engine='openpyxl', sheet_name='in')
```

```
# Read data first 5 rows
df.head()
```

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	TOT_SALES
0	43390	1	1000	1	5	Natural Chip Compny SeaSalt175g	2	6.0
1	43599	1	1307	348	66	CCs Nacho Cheese 175g	3	6.3
2	43605	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	2	2.9
3	43329	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion 175g	5	15.0
4	43330	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	3	13.8

```
# View the shape of the DataFrame
# rows = 264,836
# columns = 8
print("Shape:", df.shape)
```

```
Shape: (264836, 8)
```

```
# Checking the info about columns, data types, and non-null values
# 6 columns are integers
# 1 column is object
# 1 column is float
df.info()
```

```
<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
```

```
# Checking the summary statistics for numerical columns
df.describe()
```

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_QTY	TOT_SALES
count	264836.000000	264836.00000	2.648360e+05	2.648360e+05	264836.000000	264836.000000	264836.000000
mean	43464.036260	135.08011	1.355495e+05	1.351583e+05	56.583157	1.907309	7.304200
std	105.389282	76.78418	8.057998e+04	7.813303e+04	32.826638	0.643654	3.083226
min	43282.000000	1.00000	1.000000e+03	1.000000e+00	1.000000	1.000000	1.500000
25%	43373.000000	70.00000	7.002100e+04	6.760150e+04	28.000000	2.000000	5.400000
50%	43464.000000	130.00000	1.303575e+05	1.351375e+05	56.000000	2.000000	7.400000
75%	43555.000000	203.00000	2.030942e+05	2.027012e+05	85.000000	2.000000	9.200000
max	43646.000000	272.00000	2.373711e+06	2.415841e+06	114.000000	200.000000	650.000000

```
# Viewing column names
df.columns
```

```
Index(['DATE', 'STORE_NBR', 'LYLTY_CARD_NBR', 'TXN_ID', 'PROD_NBR',
       'PROD_NAME', 'PROD_QTY', 'TOT_SALES'],
      dtype='object')
```

```
# Counting unique values per column
df.nunique()
```

	0
DATE	364
STORE_NBR	272
LYLTY_CARD_NBR	72637
TXN_ID	263127
PROD_NBR	114
PROD_NAME	114
PROD_QTY	6
TOT_SALES	112

dtype: int64

```
# Checking for duplicated rows
# No duplicated rows
df.duplicated().sum()
```

```
np.int64(1)
```

```
# Summary of categorical features
df.select_dtypes(include='object').describe()
```

	PROD_NAME
count	264836
unique	114
top	Kettle Mozzarella Basil & Pesto 175g
freq	3304

```
# Checking for missing values
# No missing values
df.isnull().sum()
```

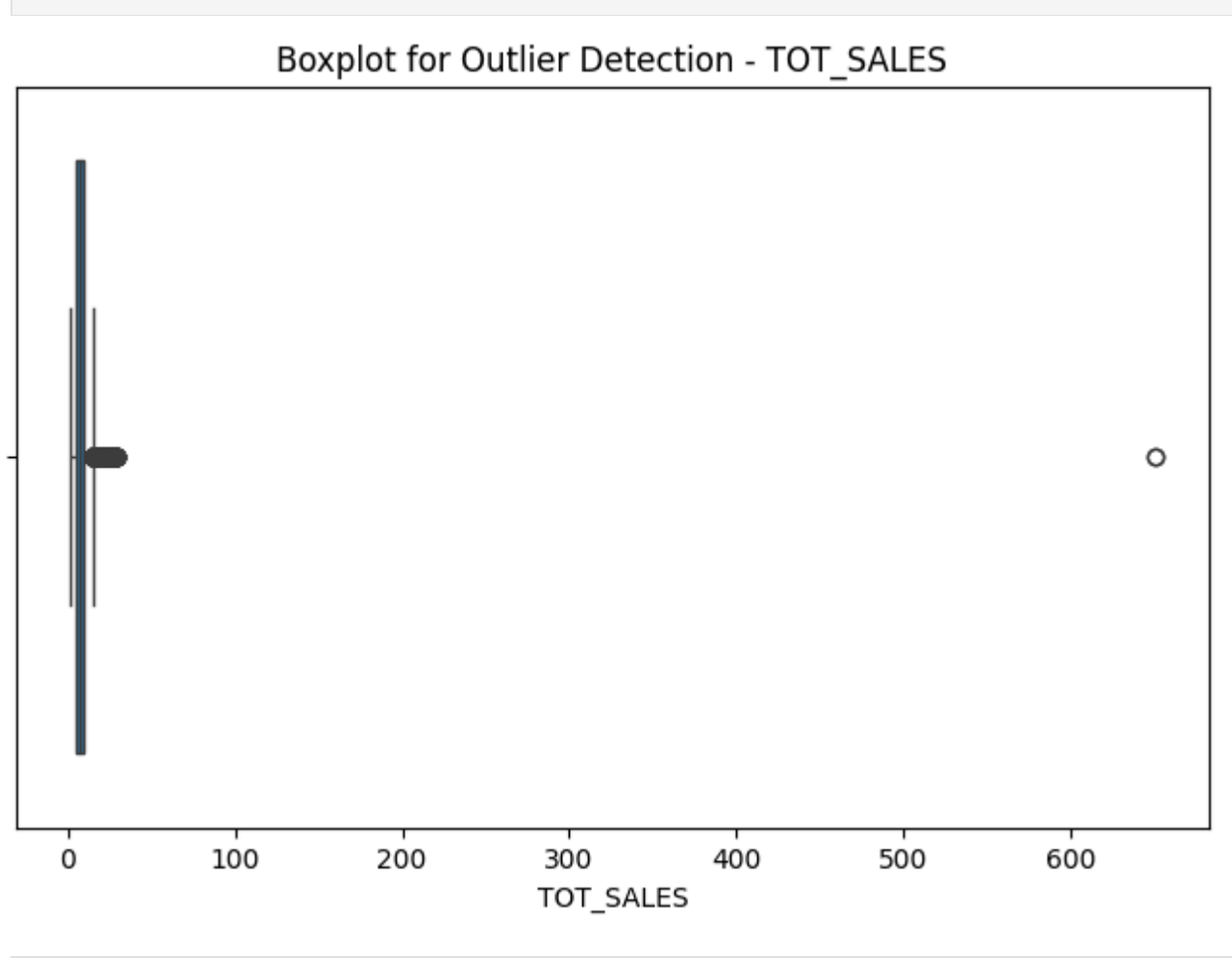
	0
DATE	0
STORE_NBR	0
LYLTY_CARD_NBR	0
TXN_ID	0
PROD_NBR	0
PROD_NAME	0
PROD_QTY	0
TOT_SALES	0

dtype: int64

```
# Converting serial date to datetime (Excel uses 1900 date system by default)
df['CLEANED_DATE'] = pd.to_datetime(df['DATE'], origin='1899-12-30', unit='D')
```

```
# Fixing date column as  anew cleaned and formatted column cleaned_date

# Convert serial date to datetime (Excel uses 1900 date system by default)
plt.figure(figsize=(8, 5))
sns.boxplot(x=df['TOT_SALES'])
plt.title('Boxplot for Outlier Detection - TOT_SALES')
plt.xlabel('TOT_SALES')
plt.show()
```

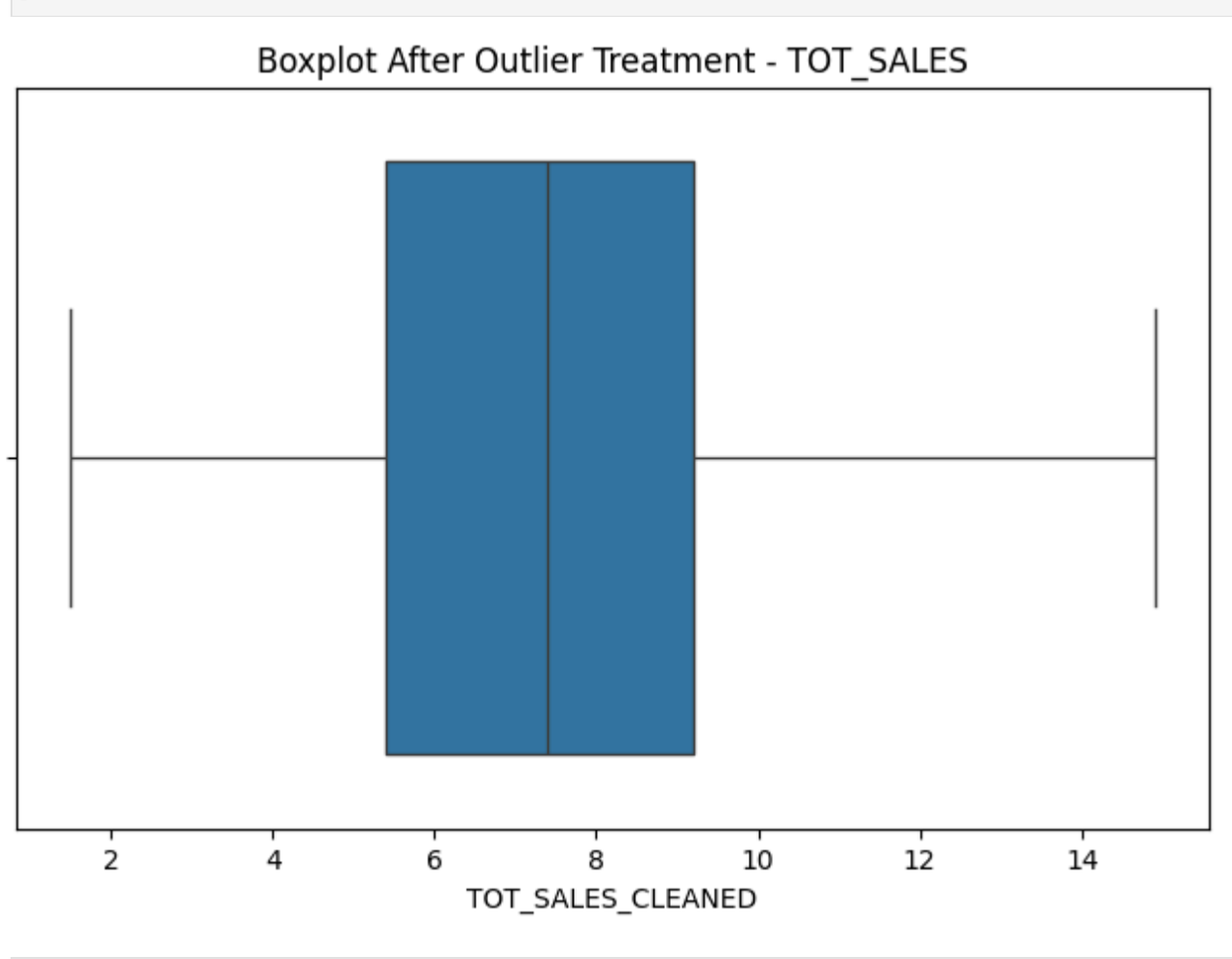



```
# FixINg outliers in 'TOT_SALES' using IQR method
Q1 = df['TOT_SALES'].quantile(0.25)
Q3 = df['TOT_SALES'].quantile(0.75)
IQR = Q3 - Q1

# Defining lower and upper bounds
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

# Capping outliers
df['TOT_SALES_CLEANED'] = df['TOT_SALES'].clip(lower=lower_bound, upper=upper_bound)

# Boxplot of cleaned data
plt.figure(figsize=(8, 5))
sns.boxplot(x=df['TOT_SALES_CLEANED'])
plt.title('Boxplot After Outlier Treatment - TOT_SALES')
plt.xlabel('TOT_SALES_CLEANED')
plt.show()
```




```
# Computing the correlation matrix
correlation = df.corr(numeric_only=True)

# Choosing a valid Plotly pastel-like color scale
colorscale = 'pinkyl'

# Creating heatmap using Plotly Graph Objects
fig = go.Figure(data=go.Heatmap(
    z=correlation.values,
    x=correlation.columns,
    y=correlation.index,
    colorscale=colorscale,
    colorbar=dict(title='Correlation Coefficient')
))

fig.update_layout(
    title='Correlation Heatmap (Pastel Theme)',
    xaxis_title='Features',
    yaxis_title='Features',
    width=800,
    height=600,
    template='plotly_white'
)

fig.show()
```

Customer Data

```
# Data is directly connected to goodgle drive from google colab console
df1 = pd.read_csv('/content/drive/MyDrive/Analytical Engineering /Portfolio/QVI_purchase_behaviour.csv')
```

```
# Read data first 5 rows
df1.head()
```

	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

```
# View the shape of the DataFrame
# rows = 72,637
# columns = 3
print("Shape:", df1.shape)
```

```
Shape: (72637, 3)
```

```
# Checking the info about columns, data types, and non-null values
# 2 columns are objects
# 1 column is integer
df1.info()
```

```
<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
```

```
# Checking the summary statistics for numerical columns
df1.describe()
```

	LYLTY_CARD_NBR
count	7.263700e+04
mean	1.361859e+05
std	8.989293e+04
min	1.000000e+03
25%	6.620200e+04
50%	1.340400e+05
75%	2.033750e+05
max	2.373711e+06

```
# Counting unique values per column
df.nunique()
```

	0
DATE	364
STORE_NBR	272
LYLTY_CARD_NBR	72637
TXN_ID	263127
PROD_NBR	114
PROD_NAME	114
PROD_QTY	6
TOT_SALES	112
TOT_SALES_CLEANED	82
CLEANED_DATE	364

dtype: int64

```
# Checking for duplicated rows
# No duplicated rows
df.duplicated().sum()
```

```
np.int64(1)
```

```
# Viewing unique values of column LIFESTAGE
lifestage_values = df1['LIFESTAGE'].value_counts()
print(f"LIFESTAGE UNIQUE VALUES: {lifestage_values}")
```

```
LIFESTAGE UNIQUE VALUES: LIFESTAGE
RETIREES                  14805
OLDER SINGLES/COUPLES     14609
YOUNG SINGLES/COUPLES     14441
OLDER FAMILIES             9780
YOUNG FAMILIES             9178
MIDAGE SINGLES/COUPLES     7275
NEW FAMILIES               2549
Name: count, dtype: int64
```

```
# Viewing unique values of column PREMIUM_CUSTOMER
customer_values = df1['PREMIUM_CUSTOMER'].value_counts()
print(f"PREMIUM CUSTOMER UNIQUE VALUES: {customer_values}")
```

```
PREMIUM CUSTOMER UNIQUE VALUES: PREMIUM_CUSTOMER
Mainstream    29245
Budget        24470
Premium       18922
Name: count, dtype: int64
```

```
# Checking for missing values
# No missing values
df1.isnull().sum()
```

	0
LYLTY_CARD_NBR	0
LIFESTAGE	0
PREMIUM_CUSTOMER	0

dtype: int64

```
# Append df1 to df as a new data table (stacked vertically)
# Ensure both DataFrames have the same columns
# Merge using inner join with column LYLTY_CARD_NBR
df_merged = pd.merge(df, df1, on='LYLTY_CARD_NBR', how='inner', suffixes=('_df', '_df1'))

print(df_merged)
```

```
         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
...       ...        ...             ...     ...       ...
264831  43533        272          272319  270088        89
264832  43325        272          272358  270154        74
264833  43410        272          272379  270187        51
264834  43461        272          272379  270188        42
264835  43365        272          272380  270189        74

                                       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
...                                          ...       ...        ...
264831   Kettle Sweet Chilli And Sour Cream 175g         2       10.8
264832             Tostitos Splash Of  Lime 175g         1        4.4
264833                  Doritos Mexicana    170g         2        8.8
264834   Doritos Corn Chip Mexican Jalapeno 150g         2        7.8
264835             Tostitos Splash Of  Lime 175g         2        8.8

        TOT_SALES_CLEANED CLEANED_DATE               LIFESTAGE  \
0                     6.0   2018-10-17   YOUNG SINGLES/COUPLES
1                     6.3   2019-05-14  MIDAGE SINGLES/COUPLES
2                     2.9   2019-05-20  MIDAGE SINGLES/COUPLES
3                    14.9   2018-08-17  MIDAGE SINGLES/COUPLES
4                    13.8   2018-08-18  MIDAGE SINGLES/COUPLES
...                   ...          ...                     ...
264831               10.8   2019-03-09   YOUNG SINGLES/COUPLES
264832                4.4   2018-08-13   YOUNG SINGLES/COUPLES
264833                8.8   2018-11-06   YOUNG SINGLES/COUPLES
264834                7.8   2018-12-27   YOUNG SINGLES/COUPLES
264835                8.8   2018-09-22   YOUNG SINGLES/COUPLES

       PREMIUM_CUSTOMER
0               Premium
1                Budget
2                Budget
3                Budget
4                Budget
...                 ...
264831          Premium
264832          Premium
264833          Premium
264834          Premium
264835          Premium

[264836 rows x 12 columns]
```

```
# Viewing merged data
df_merged.head()
```

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	TOT_SALES	TOT_SALES_CLEANED	CLEANED_DATE	LIFESTAGE	PREMIUM_CUSTOMER
0	43390	1	1000	1	5	Natural Chip Compny SeaSalt175g	2	6.0	6.0	2018-10-17	YOUNG SINGLES/COUPLES	Premium
1	43599	1	1307	348	66	CCs Nacho Cheese 175g	3	6.3	6.3	2019-05-14	MIDAGE SINGLES/COUPLES	Budget
2	43605	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	2	2.9	2.9	2019-05-20	MIDAGE SINGLES/COUPLES	Budget
3	43329	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion 175g	5	15.0	14.9	2018-08-17	MIDAGE SINGLES/COUPLES	Budget
4	43330	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	3	13.8	13.8	2018-08-18	MIDAGE SINGLES/COUPLES	Budget

```
# Moving CLEANED_DATE to the first column
df_merged = df_merged[['CLEANED_DATE'] + [col for col in df_merged.columns if col != 'CLEANED_DATE']]
```

```
# Viewing dataset
df_merged.head()
```

	CLEANED_DATE	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	TOT_SALES	TOT_SALES_CLEANED	LIFESTAGE	PREMIUM_CUSTOMER
0	2018-10-17	43390	1	1000	1	5	Natural Chip Compny SeaSalt175g	2	6.0	6.0	YOUNG SINGLES/COUPLES	Premium
1	2019-05-14	43599	1	1307	348	66	CCs Nacho Cheese 175g	3	6.3	6.3	MIDAGE SINGLES/COUPLES	Budget
2	2019-05-20	43605	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	2	2.9	2.9	MIDAGE SINGLES/COUPLES	Budget
3	2018-08-17	43329	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion 175g	5	15.0	14.9	MIDAGE SINGLES/COUPLES	Budget
4	2018-08-18	43330	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	3	13.8	13.8	MIDAGE SINGLES/COUPLES	Budget

```
# Dropping unecessary columns from data
df_merged = df_merged.drop(columns=['DATE', 'LIFESTAGE_df', 'PREMIUM_CUSTOMER_df',      'TOT_SALES'], errors='ignore')
```

```
# Viewing dataset
df_merged.head()
```

	CLEANED_DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	TOT_SALES_CLEANED	LIFESTAGE	PREMIUM_CUSTOMER
0	2018-10-17	1	1000	1	5	Natural Chip Compny SeaSalt175g	2	6.0	YOUNG SINGLES/COUPLES	Premium
1	2019-05-14	1	1307	348	66	CCs Nacho Cheese 175g	3	6.3	MIDAGE SINGLES/COUPLES	Budget
2	2019-05-20	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	2	2.9	MIDAGE SINGLES/COUPLES	Budget
3	2018-08-17	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion 175g	5	14.9	MIDAGE SINGLES/COUPLES	Budget
4	2018-08-18	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	3	13.8	MIDAGE SINGLES/COUPLES	Budget

```
# Code to rename column
# Define your renaming dictionary
rename_column = {
    'TOT_SALES_CLEANED': 'TOT_SALES',
    'LIFESTAGE_df1': 'LIFESTAGE',
    'PREMIUM_CUSTOMER_df1': 'PREMIUM_CUSTOMER'
}

# Apply renaming
df_merged = df_merged.rename(columns=rename_column)
```

```
# View dataset
df_merged.head()
```

	CLEANED_DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	TOT_SALES	LIFESTAGE	PREMIUM_CUSTOMER
0	2018-10-17	1	1000	1	5	Natural Chip Compny SeaSalt175g	2	6.0	YOUNG SINGLES/COUPLES	Premium
1	2019-05-14	1	1307	348	66	CCs Nacho Cheese 175g	3	6.3	MIDAGE SINGLES/COUPLES	Budget
2	2019-05-20	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	2	2.9	MIDAGE SINGLES/COUPLES	Budget
3	2018-08-17	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion 175g	5	14.9	MIDAGE SINGLES/COUPLES	Budget
4	2018-08-18	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	3	13.8	MIDAGE SINGLES/COUPLES	Budget

```
import os

# Create the directory if it doesn't exist
folder_path = '/content/drive/MyDrive/Analytical Engineering /Portfolio'
os.makedirs(folder_path, exist_ok=True)

# Full file path
save_path = os.path.join(folder_path, 'cleaned_data.csv')

# Save the DataFrame
df_merged.to_csv(save_path, index=False)

print(f"File saved successfully to: {save_path}")
```

```
File saved successfully to: /content/drive/MyDrive/Analytical Engineering /Portfolio/cleaned_data.csv
```

Link to dashboard on looker Dashboard