```
#load required libraries

import pandas as pd;
import matplotlib.pyplot as plt;
import numpy as np;
import seaborn as sns;
import re
from collections import Counter
from scipy.stats import iqr;
import scipy.stats as stats
from datetime import datetime

# load traction data dataset

transaction_data =
pd.read_excel(r'/home/jerome mugita/Downloads/QVI_transaction_data.xlsx
', sheet_name = 'in')

transaction_data_copy = transaction_data
transaction_data_copy
```

	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


[264836 rows x 8 columns]
```

```
# Explanatory Data Analysis for transaction Data
```

```
transaction_data.head(10)
```

```
    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
5  43604          4            4074    2982        57
6  43601          4            4149    3333        16
7  43601          4            4196    3539        24
8  43332          5            5026    4525        42
9  43330          7            7150    6900        52

                                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
5  Old El Paso Salsa   Dip Tomato Mild 300g         1        5.1
6  Smiths Crinkle Chips Salt & Vinegar 330g         1        5.7
7     Grain Waves         Sweet Chilli 210g         1        3.6
8   Doritos Corn Chip Mexican Jalapeno 150g         1        3.9
9     Grain Waves Sour    Cream&Chives 210G         2        7.2
```

```
transaction_data.dtypes
```

```
DATE              int64
STORE_NBR         int64
LYLTY_CARD_NBR    int64
TXN_ID            int64
PROD_NBR          int64
PROD_NAME        object
PROD_QTY          int64
TOT_SALES       float64
dtype: object
```

```
transaction_data['PROD_NAME'] = transaction_data['PROD_NAME']

transaction_data.dtypes
```

```
DATE                int64
STORE_NBR           int64
LYLTY_CARD_NBR      int64
TXN_ID              int64
PROD_NBR            int64
PROD_NAME          object
PROD_QTY            int64
TOT_SALES         float64
dtype: object
```

```
transaction_data['DATE'] = pd.to_datetime(transaction_data['DATE'],
origin='1899-12-30', unit='D').dt.strftime('%Y-%m-%d')

transaction_data.dtypes
```

```
DATE               object
STORE_NBR           int64
LYLTY_CARD_NBR      int64
TXN_ID              int64
PROD_NBR            int64
PROD_NAME          object
PROD_QTY            int64
TOT_SALES         float64
dtype: object
```

```
transaction_data.head(10)
```

```
         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
5  2019-05-19          4            4074    2982        57
6  2019-05-16          4            4149    3333        16
7  2019-05-16          4            4196    3539        24
8  2018-08-20          5            5026    4525        42
9  2018-08-18          7            7150    6900        52

                                  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
5  Old El Paso Salsa   Dip Tomato Mild 300g         1        5.1
6  Smiths Crinkle Chips Salt & Vinegar 330g         1        5.7
7     Grain Waves         Sweet Chilli 210g         1        3.6
```

```
8   Doritos Corn Chip Mexican Jalapeno 150g         1        3.9
9     Grain Waves Sour    Cream&Chives 210G         2        7.2
```

```
transaction_data.shape
```

```
(264836, 8)
```

```
transaction_data.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  object
 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(5), object(2)
memory usage: 16.2+ MB
```

```
transaction_data.describe()
```

```
          STORE_NBR  LYLTY_CARD_NBR        TXN_ID       PROD_NBR  \
count  264836.00000    2.648360e+05  2.648360e+05  264836.000000
mean      135.08011    1.355495e+05  1.351583e+05      56.583157
std        76.78418    8.057998e+04  7.813303e+04      32.826638
min         1.00000    1.000000e+03  1.000000e+00       1.000000
25%        70.00000    7.002100e+04  6.760150e+04      28.000000
50%       130.00000    1.303575e+05  1.351375e+05      56.000000
75%       203.00000    2.030942e+05  2.027012e+05      85.000000
max       272.00000    2.373711e+06  2.415841e+06     114.000000

            PROD_QTY      TOT_SALES
count  264836.000000  264836.000000
mean        1.907309       7.304200
std         0.643654       3.083226
min         1.000000       1.500000
25%         2.000000       5.400000
50%         2.000000       7.400000
75%         2.000000       9.200000
max       200.000000     650.000000
```

```
# looking for missing values
```

```
transaction_data.isnull()
```

```
         DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  PROD_NAME
0       False      False           False   False     False      False
\
1       False      False           False   False     False      False

2       False      False           False   False     False      False

3       False      False           False   False     False      False

4       False      False           False   False     False      False

...       ...        ...             ...     ...       ...        ...

264831  False      False           False   False     False      False

264832  False      False           False   False     False      False

264833  False      False           False   False     False      False

264834  False      False           False   False     False      False

264835  False      False           False   False     False      False


        PROD_QTY  TOT_SALES
0          False      False
1          False      False
2          False      False
3          False      False
4          False      False
...          ...        ...
264831     False      False
264832     False      False
264833     False      False
264834     False      False
264835     False      False

[264836 rows x 8 columns]
```

```
#computing the sum of missing values per column
transaction_data.isna().sum()
```

```
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
```

```
transaction_data.isna()
```

```
         DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  PROD_NAME
0       False      False           False   False     False      False
\
1       False      False           False   False     False      False

2       False      False           False   False     False      False

3       False      False           False   False     False      False

4       False      False           False   False     False      False

...       ...        ...             ...     ...       ...        ...

264831  False      False           False   False     False      False

264832  False      False           False   False     False      False

264833  False      False           False   False     False      False

264834  False      False           False   False     False      False

264835  False      False           False   False     False      False


        PROD_QTY  TOT_SALES
0          False      False
1          False      False
2          False      False
3          False      False
4          False      False
...          ...        ...
264831     False      False
264832     False      False
264833     False      False
264834     False      False
264835     False      False

[264836 rows x 8 columns]
```

```
transaction_data.isna().any()
```

```
DATE              False
STORE_NBR         False
```

```
LYLTY_CARD_NBR    False
TXN_ID            False
PROD_NBR          False
PROD_NAME         False
PROD_QTY          False
TOT_SALES         False
dtype: bool
```

```
transaction_data.isna().sum()
```

```
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
```

```
#sorting the transaction data
```

```
transaction_data.sort_values('TOT_SALES', ascending=False).head(10)
```

```
              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
69496   2018-08-15         49           49303   45789        14
55558   2019-05-14        190          190113  190914        14
171815  2018-08-17         24           24095   20797        14
184969  2019-05-20         44           44350   40394        14
150683  2019-05-20        118          118021  120799        14
117850  2019-05-19        194          194308  194516        14
5179    2018-08-15         94           94148   93390        14
17110   2018-08-16        172          172239  174254         7

                                    PROD_NAME  PROD_QTY  TOT_SALES
69762         Dorito Corn Chp     Supreme 380g       200      650.0
69763         Dorito Corn Chp     Supreme 380g       200      650.0
69496   Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5
55558   Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5
171815  Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5
184969  Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5
150683  Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5
117850  Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5
5179    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5
17110        Smiths Crinkle      Original 330g         5       28.5
```

```
#filtering to remove non chip products
```

```
chips_reference = ["chp", "chps", "chip", "chips", "crisps", "potato",
```

```
"corn"]
transaction_data['non_chips'] =
~transaction_data['PROD_NAME'].str.contains('|'.join(chips_reference),
case=False, regex=True)

non_chips_products = transaction_data[transaction_data['non_chips']]

transaction_data_chips =
pd.DataFrame(transaction_data[transaction_data['non_chips'] == False])

transaction_data_chips
```

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	\
0	2018-10-17	1	1000	1	5	
2	2019-05-20	1	1343	383	61	
3	2018-08-17	2	2373	974	69	
4	2018-08-18	2	2426	1038	108	
6	2019-05-16	4	4149	3333	16	
...	...	...	...	...	...	
264824	2019-03-13	272	272193	269906	9	
264826	2019-03-25	272	272194	269908	75	
264827	2018-08-28	272	272197	269911	104	
264830	2018-11-12	272	272319	270087	44	
264834	2018-12-27	272	272379	270188	42	

	PROD_NAME	PROD_QTY	TOT_SALES
0	Natural Chip Compny SeaSalt175g	2	6.0
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
6	Smiths Crinkle Chips Salt & Vinegar 330g	1	5.7
...	...	...	...
264824	Kettle Tortilla ChpsBtroot&Ricotta 150g	1	4.6
264826	Cobs Popd Sea Salt Chips 110g	2	7.6
264827	Infuzions Thai SweetChili PotatoMix 110g	2	7.6
264830	Thins Chips Light& Tangy 175g	2	6.6
264834	Doritos Corn Chip Mexican Jalapeno 150g	2	7.8

```
        non_chips
0           False
2           False
3           False
4           False
6           False
...           ...
264824      False
264826      False
264827      False
264830      False
264834      False

[103184 rows x 9 columns]
```

```
transaction_data_chips.shape
```

```
(103184, 9)
```

```
#filtering to find unique words in the dataframe

transaction_data_chips['clean_words'] =
transaction_data_chips['PROD_NAME'].str.lower().str.findall(r'\b\w+\
b')
transaction_data_chips['clean_words'] =
transaction_data_chips['clean_words'].apply(lambda words:
[re.sub(r'[^a-zA-Z\s]', '', word) for word in words])

list_of_words = [word for words in
transaction_data_chips['clean_words'] for word in words]
word_frequency = Counter(list_of_words)
sorted_words = sorted(word_frequency.items(), key=lambda x: x[1],
reverse=True)

for word, count in sorted_words:
    print(word, count)
```

```
g 97335
chips 49770
corn 22063
chip 18645
smiths 16872
doritos 15874
thins 14075
crisps 12607
salt 12584
original 12335
cobs 9693
popd 9693
kettle 9580
```

tortilla 9580
crinkle 9112
supreme 7911
cheese 7886
cut 7529
ww 7443
tyrrells 6442
chives 6427
vinegar 6300
sea 6284
cream 6225
natural 6050
chicken 4656
potato 4647
sour 4642
thinly 4527
chpshny 3296
jlpno 3296
chili 3296
swt 3269
chlli 3269
sr 3269
ched 3268
infuzions 3242
thai 3242
sweetchili 3242
potatomix 3242
crnkle 3233
orgnl 3233
big 3233
bag 3233
hot 3229
spicy 3229
mexican 3204
jalapeno 3204
light 3188
tangy 3188
dorito 3185
chp 3185
lightly 3174
salted 3174
southern 3172
nacho 3160
crm 3159
pringles 3157
chpsbtroot 3146
ricotta 3146
tostitos 3145
smoked 3145
chipotle 3145

```
chpsfeta 3138
garlic 3138
seasonedchicken 3114
chipco 3010
snbts 1576
whlgrn 1576
cheddr 1576
mstrd 1576
co 1572
tmato 1572
hrb 1572
spce 1572
vinegr 1550
barbecue 1489
stacked 1487
onionstacked 1483
chs 1481
oniong 1481
s 1473
onion 1473
d 1469
style 1469
compny 1468
seasaltg 1468
hony 1460
soy 1460
chckng 1460
originl 1441
saltd 1441
cutsalt 1440
vinegrg 1440
sunbites 1432
whlegrn 1432
frch 1432
onin 1432
french 1418
fries 1418
```

```
transaction_data_chips.sort_values('TOT_SALES',
ascending=False).head(10)
```

```
              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
69496   2018-08-15         49           49303   45789        14
184969  2019-05-20         44           44350   40394        14
5179    2018-08-15         94           94148   93390        14
55558   2019-05-14        190          190113  190914        14
117850  2019-05-19        194          194308  194516        14
171815  2018-08-17         24           24095   20797        14
150683  2019-05-20        118          118021  120799        14
```

```
135346  2018-08-15        101          101110  100677        16

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

69496     Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

184969    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

5179      Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

55558     Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

117850    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

171815    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

150683    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

135346  Smiths Crinkle Chips Salt & Vinegar 330g         5       28.5


        non_chips                                  clean_words
69762       False             [dorito, corn, chp, supreme, g]
69763       False             [dorito, corn, chp, supreme, g]
69496       False  [smiths, crnkle, chip, orgnl, big, bag, g]
184969      False  [smiths, crnkle, chip, orgnl, big, bag, g]
5179        False  [smiths, crnkle, chip, orgnl, big, bag, g]
55558       False  [smiths, crnkle, chip, orgnl, big, bag, g]
117850      False  [smiths, crnkle, chip, orgnl, big, bag, g]
171815      False  [smiths, crnkle, chip, orgnl, big, bag, g]
150683      False  [smiths, crnkle, chip, orgnl, big, bag, g]
135346      False  [smiths, crinkle, chips, salt, vinegar, g]
```

```
#Dropping the added columns used filtering purposes because they are
no longer needed

transaction_data_chips.drop(columns=['clean_words'], inplace=True)
transaction_data_chips.sort_values('TOT_SALES',
ascending=False).head(10)
```

```
              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
69496   2018-08-15         49           49303   45789        14
184969  2019-05-20         44           44350   40394        14
```

```
5179    2018-08-15         94           94148   93390        14
55558   2019-05-14        190          190113  190914        14
117850  2019-05-19        194          194308  194516        14
171815  2018-08-17         24           24095   20797        14
150683  2019-05-20        118          118021  120799        14
135346  2018-08-15        101          101110  100677        16

                                      PROD_NAME  PROD_QTY  TOT_SALES

69762           Dorito Corn Chp     Supreme 380g       200      650.0
\
69763           Dorito Corn Chp     Supreme 380g       200      650.0

69496     Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

184969    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

5179      Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

55558     Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

117850    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

171815    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

150683    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

135346  Smiths Crinkle Chips Salt & Vinegar 330g         5       28.5


        non_chips
69762       False
69763       False
69496       False
184969      False
5179        False
55558       False
117850      False
171815      False
150683      False
135346      False
```

```
#checking for null values
transaction_data_chips.isnull()
```

```
         DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  PROD_NAME

0       False      False           False   False     False      False
\
```

```
2       False      False           False   False     False      False

3       False      False           False   False     False      False

4       False      False           False   False     False      False

6       False      False           False   False     False      False

...       ...        ...             ...     ...       ...        ...

264824  False      False           False   False     False      False

264826  False      False           False   False     False      False

264827  False      False           False   False     False      False

264830  False      False           False   False     False      False

264834  False      False           False   False     False      False


        PROD_QTY  TOT_SALES  non_chips
0          False      False      False
2          False      False      False
3          False      False      False
4          False      False      False
6          False      False      False
...          ...        ...        ...
264824     False      False      False
264826     False      False      False
264827     False      False      False
264830     False      False      False
264834     False      False      False

[103184 rows x 9 columns]

transaction_data_chips.isnull().sum()

DATE              0
STORE_NBR         0
LYLTY_CARD_NBR    0
TXN_ID            0
PROD_NBR          0
PROD_NAME         0
PROD_QTY          0
TOT_SALES         0
non_chips         0
dtype: int64
```

```
# Finding outliers in the dataset

interQR = np.quantile(transaction_data_chips['TOT_SALES'], 0.75) -
np.quantile(transaction_data_chips['TOT_SALES'], 0.25)

lower_threashold = np.quantile(transaction_data_chips['TOT_SALES'],
0.25) - 1.5 * interQR;

upper_threashold = np.quantile(transaction_data_chips['TOT_SALES'],
0.75) + 1.5 * interQR;

transaction_data_chips[(transaction_data_chips['TOT_SALES'] <
lower_threashold) | (transaction_data_chips['TOT_SALES'] >
upper_threashold)].sort_values('TOT_SALES', ascending=False)
```

```
             DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR
69763   2019-05-20        226          226000  226210         4  \
69762   2018-08-19        226          226000  226201         4
171815  2018-08-17         24           24095   20797        14
184969  2019-05-20         44           44350   40394        14
150683  2019-05-20        118          118021  120799        14
...            ...        ...             ...     ...       ...
112122  2018-12-30        185          185321  188174        55
112100  2019-06-04        185          185006  187829        95
109793  2018-07-10        151          151247  149954        95
109788  2018-09-30        151          151143  149853        95
264751  2018-12-20        268          268315  264753        55

                                      PROD_NAME  PROD_QTY  TOT_SALES

69763           Dorito Corn Chp     Supreme 380g       200      650.0
\
69762           Dorito Corn Chp     Supreme 380g       200      650.0

171815    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

184969    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

150683    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

...                                          ...       ...        ...

112122      Snbts Whlgrn Crisps Cheddr&Mstrd 90g         1        1.7

112100  Sunbites Whlegrn    Crisps Frch/Onin 90g         1        1.7

109793  Sunbites Whlegrn    Crisps Frch/Onin 90g         1        1.7

109788  Sunbites Whlegrn    Crisps Frch/Onin 90g         1        1.7
```

```
264751      Snbts Whlgrn Crisps Cheddr&Mstrd 90g         1        1.7


        non_chips
69763       False
69762       False
171815      False
184969      False
150683      False
...           ...
112122      False
112100      False
109793      False
109788      False
264751      False

[664 rows x 9 columns]
```

```
transaction_data_chips[transaction_data_chips['LYLTY_CARD_NBR'] ==
226000]
```

```
             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
non_chips
69762  Dorito Corn Chp     Supreme 380g       200      650.0
False
69763  Dorito Corn Chp     Supreme 380g       200      650.0
False
```

```
transaction_data_chips.drop(index=69763, inplace=True)
```

```
transaction_data_chips.sort_values('TOT_SALES', ascending=False)
```

```
              DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR
69762   2018-08-19        226          226000  226201         4  \
117850  2019-05-19        194          194308  194516        14
69496   2018-08-15         49           49303   45789        14
171815  2018-08-17         24           24095   20797        14
55558   2019-05-14        190          190113  190914        14
...            ...        ...             ...     ...       ...
128950  2019-01-12        169          169432  171575        95
135108  2019-05-18          1            1424     498        55
172139  2019-05-16        196          196097  196020        55
165104  2019-01-03        186          186347  188723        95
237925  2018-08-15         74           74115   72994        55

                                      PROD_NAME  PROD_QTY  TOT_SALES
```

```
69762           Dorito Corn Chp     Supreme 380g       200      650.0
\
117850    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

69496     Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

171815    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

55558     Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

...                                          ...       ...        ...

128950  Sunbites Whlegrn    Crisps Frch/Onin 90g         1        1.7

135108      Snbts Whlgrn Crisps Cheddr&Mstrd 90g         1        1.7

172139      Snbts Whlgrn Crisps Cheddr&Mstrd 90g         1        1.7

165104  Sunbites Whlegrn    Crisps Frch/Onin 90g         1        1.7

237925      Snbts Whlgrn Crisps Cheddr&Mstrd 90g         1        1.7


        non_chips
69762       False
117850      False
69496       False
171815      False
55558       False
...           ...
128950      False
135108      False
172139      False
165104      False
237925      False

[103183 rows x 9 columns]
```

```
transaction_data_chips['LYLTY_CARD_NBR'].value_counts()
```

```
LYLTY_CARD_NBR
28020     10
212185    10
88105     10
69154      9
213068     9
          ..
221067     1
```

```
221064     1
220427     1
220402     1
272379     1
Name: count, Length: 51950, dtype: int64
```

```
transaction_data_chips[transaction_data_chips['LYLTY_CARD_NBR'] ==
28020]
```

```
            DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR
70687  2018-08-07         28           28020   24647        29  \
70688  2018-08-31         28           28020   24648         4
70689  2018-10-16         28           28020   24649       100
70690  2018-11-06         28           28020   24650        42
70692  2019-01-21         28           28020   24652        16
70693  2019-02-21         28           28020   24653        79
70695  2019-03-22         28           28020   24655       111
70696  2019-03-30         28           28020   24656       104
70697  2019-06-06         28           28020   24657       106
70698  2019-06-17         28           28020   24658        47

                                      PROD_NAME  PROD_QTY  TOT_SALES

70687            French Fries Potato Chips 175g         2
6.0  \
70688          Dorito Corn Chp     Supreme 380g         2       13.0

70689   Smiths Crinkle Cut  Chips Chs&Onion170g         2        5.8

70690   Doritos Corn Chip Mexican Jalapeno 150g         2        7.8

70692  Smiths Crinkle Chips Salt & Vinegar 330g         2       11.4

70693    Smiths Chip Thinly  CutSalt/Vinegr175g         2        6.0

70695     Smiths Chip Thinly  Cut Original 175g         2        6.0

70696  Infuzions Thai SweetChili PotatoMix 110g         2        7.6

70697    Natural ChipCo      Hony Soy Chckn175g         2        6.0

70698         Doritos Corn Chips  Original 170g         2        8.8


       non_chips
70687      False
70688      False
70689      False
70690      False
```

```
70692      False
70693      False
70695      False
70696      False
70697      False
70698      False
```

```
transaction_data_chips['DATE'].value_counts()
```

```
DATE
2018-12-24    379
2018-12-23    360
2018-12-19    354
2019-06-14    343
2018-12-22    339
             ...
2019-04-01    245
2018-08-28    241
2018-11-25    240
2018-08-17    236
2018-10-18    230
Name: count, Length: 364, dtype: int64
```

```
transaction_data_chips.sort_values('DATE', ascending=False)
```

```
              DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR
246216  2019-06-30        101          101071  100462        12  \
242449  2019-06-30         53           53172   47429        75
11469   2019-06-30        140          140386  142194        60
73823   2019-06-30        101          101047  100323        47
264190  2019-06-30        244          244213  247339        93
...            ...        ...             ...     ...       ...
118675  2018-07-01         10           10120    9750        69
49749   2018-07-01        201          201359  201500       104
30722   2018-07-01         40           40183   36945       104
111053  2018-07-01        168          168065  169740        44
18172   2018-07-01         39           39077   35094       104

                                       PROD_NAME  PROD_QTY  TOT_SALES

246216   Natural Chip Co     Tmato Hrb&Spce 175g         2        6.0
\
242449            Cobs Popd Sea Salt  Chips 110g         2        7.6

11469       Kettle Tortilla ChpsFeta&Garlic 150g         1        4.6

73823          Doritos Corn Chips  Original 170g         2        8.8

264190   Doritos Corn Chip Southern Chicken 150g         2        7.8
```

```
...                                          ...       ...        ...

118675    Smiths Chip Thinly  S/Cream&Onion 175g         2        6.0

49749   Infuzions Thai SweetChili PotatoMix 110g         2        7.6

30722   Infuzions Thai SweetChili PotatoMix 110g         2        7.6

111053            Thins Chips Light&  Tangy 175g         2        6.6

18172   Infuzions Thai SweetChili PotatoMix 110g         2        7.6


        non_chips
246216      False
242449      False
11469       False
73823       False
264190      False
...           ...
118675      False
49749       False
30722       False
111053      False
18172       False

[103183 rows x 9 columns]

transaction_data_chips[(transaction_data_chips['DATE'] >= "2018-07-
01") & (transaction_data_chips['DATE'] <= "2019-07-30")]

              DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR
0       2018-10-17          1            1000       1         5  \
2       2019-05-20          1            1343     383        61
3       2018-08-17          2            2373     974        69
4       2018-08-18          2            2426    1038       108
6       2019-05-16          4            4149    3333        16
...            ...        ...             ...     ...       ...
264824  2019-03-13        272          272193  269906         9
264826  2019-03-25        272          272194  269908        75
264827  2018-08-28        272          272197  269911       104
264830  2018-11-12        272          272319  270087        44
264834  2018-12-27        272          272379  270188        42

                                      PROD_NAME  PROD_QTY  TOT_SALES

0         Natural Chip        Compny SeaSalt175g         2        6.0
\
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

6       Smiths Crinkle Chips Salt & Vinegar 330g         1        5.7

...                                        ...       ...        ...

264824   Kettle Tortilla ChpsBtroot&Ricotta 150g         1        4.6

264826            Cobs Popd Sea Salt  Chips 110g         2        7.6

264827  Infuzions Thai SweetChili PotatoMix 110g         2        7.6

264830            Thins Chips Light&  Tangy 175g         2        6.6

264834   Doritos Corn Chip Mexican Jalapeno 150g         2        7.8


        non_chips
0           False
2           False
3           False
4           False
6           False
...           ...
264824      False
264826      False
264827      False
264830      False
264834      False

[103183 rows x 9 columns]
```

```
# Create a date range from 1st July 2018 to 30th June 2019
start_date = '2018-07-01'
end_date = '2019-06-30'
date_range = pd.date_range(start=start_date, end=end_date, freq='D')

datesDF = pd.DataFrame({'DATE' : date_range})
datesDF
```

```
          DATE
0   2018-07-01
1   2018-07-02
2   2018-07-03
3   2018-07-04
4   2018-07-05
```

```
..          ...
360 2019-06-26
361 2019-06-27
362 2019-06-28
363 2019-06-29
364 2019-06-30

[365 rows x 1 columns]
```

```
datesDF['DATE'] = datesDF['DATE'].astype(object)
```

```
datesDF.dtypes
```

```
DATE    object
dtype: object
```

```
transactions_datesDF = datesDF.merge(transaction_data_chips,
on='DATE', how='outer')
```

```
transactions_datesDF
```

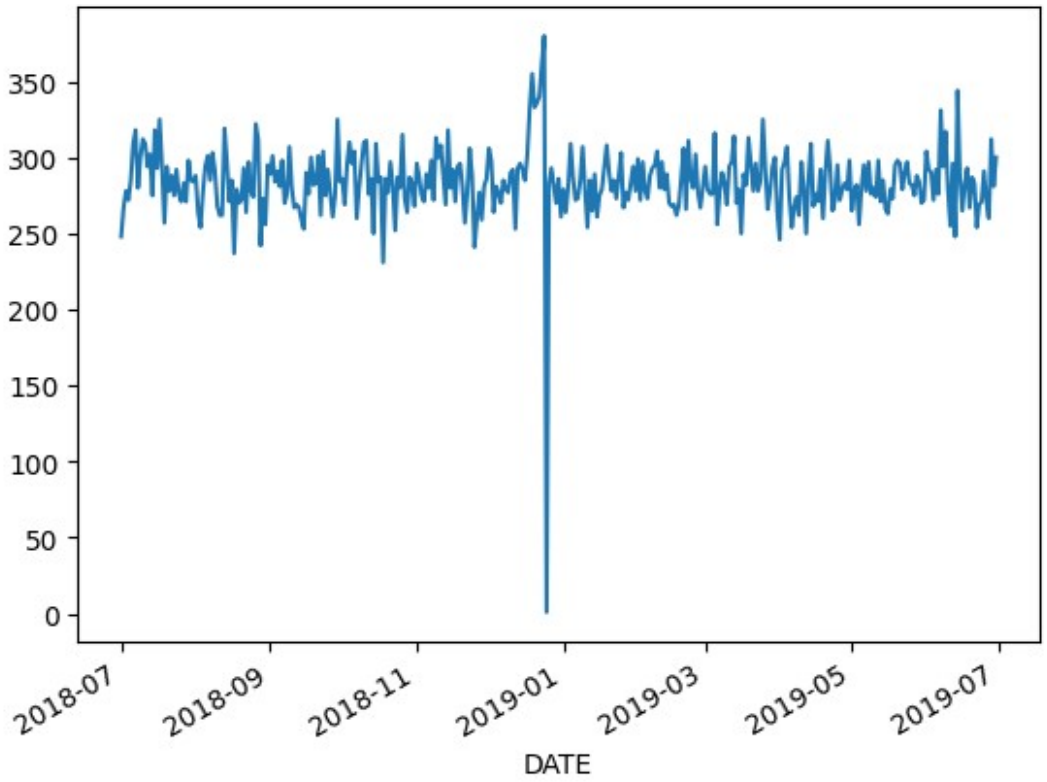
```
                     DATE  STORE_NBR  LYLTY_CARD_NBR    TXN_ID
PROD_NBR
0       2018-07-01 00:00:00        NaN             NaN       NaN
NaN  \
1       2018-07-02 00:00:00        NaN             NaN       NaN
NaN
2       2018-07-03 00:00:00        NaN             NaN       NaN
NaN
3       2018-07-04 00:00:00        NaN             NaN       NaN
NaN
4       2018-07-05 00:00:00        NaN             NaN       NaN
NaN
...                     ...        ...             ...       ...
...
103543  2018-12-30 00:00:00       72.0         72300.0   71912.0
30.0
103544  2018-12-30 00:00:00      128.0        128188.0  131812.0
8.0
103545  2018-12-30 00:00:00      169.0        169125.0  171170.0
5.0
103546  2018-12-30 00:00:00      247.0        247066.0  248988.0
106.0
103547  2018-12-30 00:00:00      249.0        249035.0  250882.0
42.0

                                     PROD_NAME  PROD_QTY  TOT_SALES
non_chips
0                                          NaN       NaN        NaN
```

```
NaN
1                                          NaN       NaN        NaN
NaN
2                                          NaN       NaN        NaN
NaN
3                                          NaN       NaN        NaN
NaN
4                                          NaN       NaN        NaN
NaN
...                                        ...       ...        ...
...
103543  Doritos Corn Chips  Cheese Supreme 170g       2.0        8.8
False
103544  Smiths Crinkle Cut  Chips Original 170g       2.0        5.8
False
103545   Natural Chip        Compny SeaSalt175g       2.0        6.0
False
103546   Natural ChipCo      Hony Soy Chckn175g       2.0        6.0
False
103547  Doritos Corn Chip Mexican Jalapeno 150g       2.0        7.8
False

[103548 rows x 9 columns]
```

```
plot_transactions_day = transactions_datesDF['DATE'].value_counts()
plot_transactions_day
```

```
DATE
2018-12-24    380
2018-12-23    361
2018-12-19    355
2019-06-14    344
2018-12-22    340
              ...
2018-08-28    242
2018-11-25    241
2018-08-17    237
2018-10-18    231
2018-12-25      1
Name: count, Length: 365, dtype: int64
```

```
plot_transactions_day.plot(kind='line', x='DATE')
plt.figure(figsize=(20, 6))
plt.show()
```



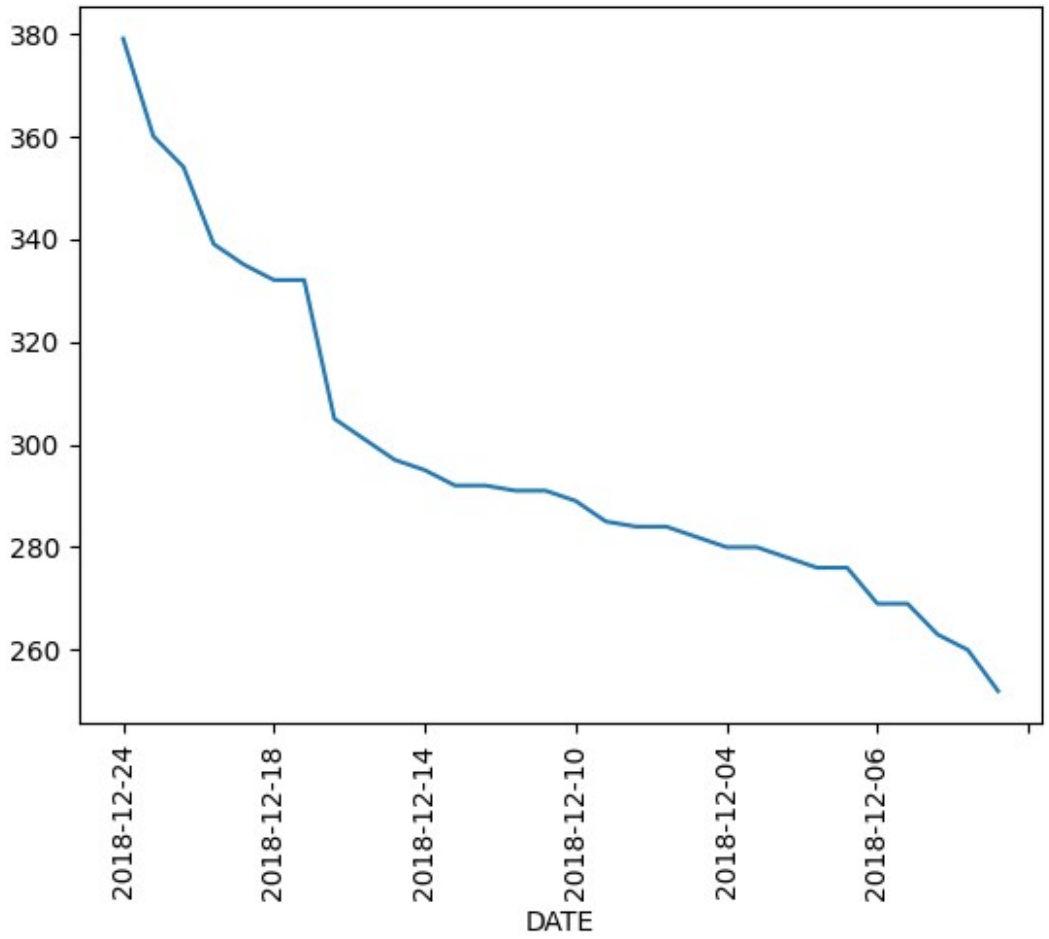

```
<Figure size 2000x600 with 0 Axes>
```

```
december_transactions =
transaction_data_chips[(transaction_data_chips['DATE'] >= "2018-12-
01") & (transaction_data_chips['DATE'] <= "2018-12-31")]
december_transactions.sort_values('DATE', ascending=True)
```

```
             DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR
197018  2018-12-01        168          168012  169390        75  \
19549   2018-12-01         79           79352   78222        30
245429  2018-12-01         89           89107   88232        83
178507  2018-12-01        130          130041  133813        75
109754  2018-12-01        150          150107  149290       104
...            ...        ...             ...     ...       ...
141481  2018-12-31        105          105110  105945        77
77782   2018-12-31        196          196030  195580        27
141679  2018-12-31        109          109131  110954        33
76600   2018-12-31        165          165218  166410        33
161487  2018-12-31        136          136415  138788         8

                                      PROD_NAME  PROD_QTY  TOT_SALES

197018            Cobs Popd Sea Salt  Chips 110g         2        7.6
\
19549    Doritos Corn Chips  Cheese Supreme 170g         2        8.8
```

```
245429         WW D/Style Chip     Sea Salt 200g         1        1.9

178507            Cobs Popd Sea Salt  Chips 110g         2        7.6

109754  Infuzions Thai SweetChili PotatoMix 110g         2        7.6

...                                          ...       ...        ...

141481     Doritos Corn Chips  Nacho Cheese 170g         2        8.8

77782        WW Supreme Cheese   Corn Chips 200g         2        3.8

141679  Cobs Popd Swt/Chlli &Sr/Cream Chips 110g         2        7.6

76600   Cobs Popd Swt/Chlli &Sr/Cream Chips 110g         2        7.6

161487   Smiths Crinkle Cut  Chips Original 170g         1        2.9


        non_chips
197018      False
19549       False
245429      False
178507      False
109754      False
...           ...
141481      False
77782       False
141679      False
76600       False
161487      False

[8922 rows x 9 columns]
```

```
december_transactions['DATE'].value_counts().plot(kind='line')
plt.xticks(rotation=90)
plt.show()
```

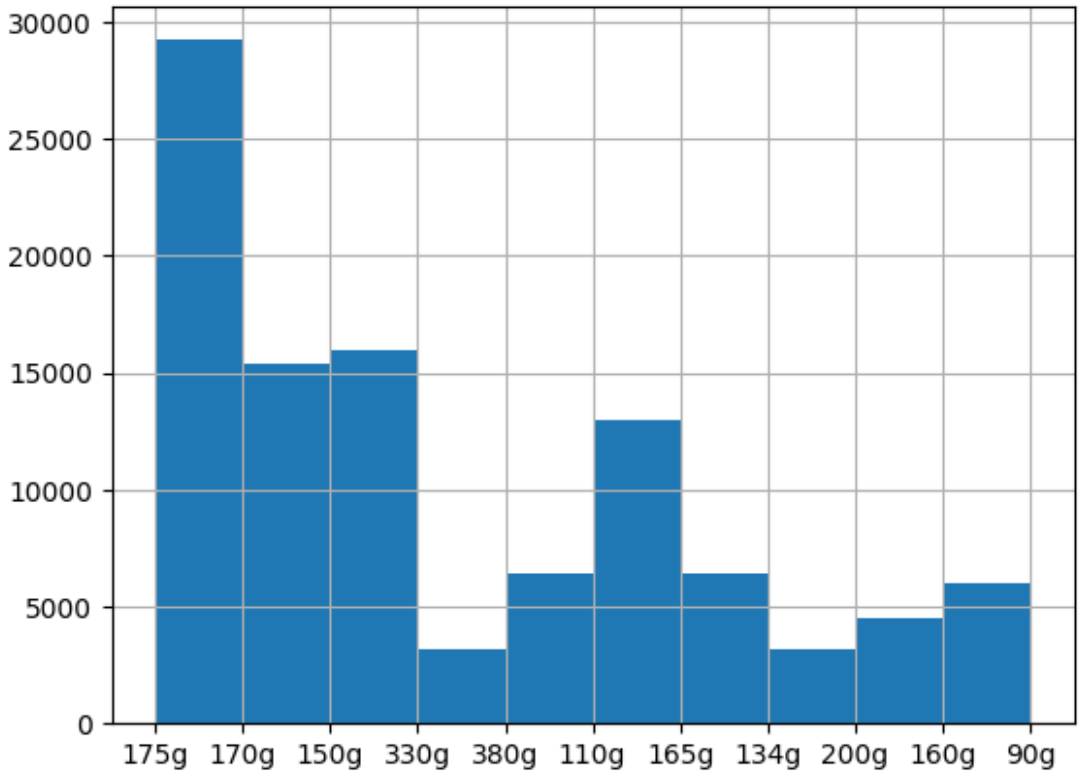



```
transaction_data_chips[['BRAND', 'PACK_SIZE']] =
transaction_data_chips['PROD_NAME'].str.extract(r'([^\d]+)(\d+g)')

transaction_data_chips.head(150)
```

```
           DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR
0    2018-10-17          1            1000       1         5  \
2    2019-05-20          1            1343     383        61
3    2018-08-17          2            2373     974        69
4    2018-08-18          2            2426    1038       108
6    2019-05-16          4            4149    3333        16
..          ...        ...             ...     ...       ...
361  2018-08-04          7            7150    6899        90
364  2019-01-05          7            7150    6903       104
369  2019-03-15          7            7173    7002        14
370  2019-04-16          7            7173    7003        28
371  2019-04-24          7            7173    7004        16

                                    PROD_NAME  PROD_QTY  TOT_SALES
non_chips
0      Natural Chip        Compny SeaSalt175g         2        6.0
```

```
False  \
2      Smiths Crinkle Cut  Chips Chicken 170g         2        2.9
False
3      Smiths Chip Thinly  S/Cream&Onion 175g         5       15.0
False
4    Kettle Tortilla ChpsHny&Jlpno Chili 150g         3       13.8
False
6    Smiths Crinkle Chips Salt & Vinegar 330g         1        5.7
False
..                                          ...       ...        ...
...
361         Tostitos Smoked     Chipotle 175g         2        8.8
False
364  Infuzions Thai SweetChili PotatoMix 110g         2        7.6
False
369    Smiths Crnkle Chip  Orgnl Big Bag 380g         2       11.8
False
370      Thins Potato Chips  Hot & Spicy 175g         2        6.6
False
371  Smiths Crinkle Chips Salt & Vinegar 330g         2       11.4
False

                                    BRAND PACK_SIZE
0      Natural Chip        Compny SeaSalt      175g
2      Smiths Crinkle Cut  Chips Chicken       170g
3      Smiths Chip Thinly  S/Cream&Onion       175g
4    Kettle Tortilla ChpsHny&Jlpno Chili       150g
6    Smiths Crinkle Chips Salt & Vinegar       330g
..                                     ...       ...
361         Tostitos Smoked     Chipotle       175g
364  Infuzions Thai SweetChili PotatoMix       110g
369    Smiths Crnkle Chip  Orgnl Big Bag       380g
370      Thins Potato Chips  Hot & Spicy       175g
371  Smiths Crinkle Chips Salt & Vinegar       330g

[150 rows x 11 columns]
```

```
# plot histogram of pack sizes

transaction_data_chips['PACK_SIZE'].hist()

plt.show()
```




```
transaction_data_chips['PACK_SIZE'].value_counts()
```

```
PACK_SIZE
175g    29215
150g    15956
170g    15413
110g    12935
165g     6442
380g     6417
200g     4473
330g     3197
134g     3157
90g      3008
160g     2970
Name: count, dtype: int64
```

```
transaction_data_chips[transaction_data_chips['BRAND'] == 'RED']
```

```
Empty DataFrame
Columns: [DATE, STORE_NBR, LYLTY_CARD_NBR, TXN_ID, PROD_NBR,
PROD_NAME, PROD_QTY, TOT_SALES, non_chips, BRAND, PACK_SIZE]
Index: []
```

```
#loading the purchase behavior dataset
purchase_behaviour =
pd.read_csv(r'/home/jeromemugita/Downloads/QVI_purchase_behaviour.csv'
```

```
)
purchase_behaviour
```

```
       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
...               ...                     ...              ...
72632         2370651  MIDAGE SINGLES/COUPLES       Mainstream
72633         2370701          YOUNG FAMILIES       Mainstream
72634         2370751          YOUNG FAMILIES          Premium
72635         2370961          OLDER FAMILIES           Budget
72636         2373711   YOUNG SINGLES/COUPLES       Mainstream

[72637 rows x 3 columns]
```

```
purchase_behaviour.shape
```

```
(72637, 3)
```

```
purchase_behaviour.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
```

```
purchase_behaviour.isna()
```

```
       LYLTY_CARD_NBR  LIFESTAGE  PREMIUM_CUSTOMER
0               False      False             False
1               False      False             False
2               False      False             False
3               False      False             False
4               False      False             False
...               ...        ...               ...
72632           False      False             False
72633           False      False             False
72634           False      False             False
72635           False      False             False
72636           False      False             False

[72637 rows x 3 columns]
```

```
purchase_behaviour.isna().any()
```

```
LYLTY_CARD_NBR      False
LIFESTAGE           False
PREMIUM_CUSTOMER    False
dtype: bool
```

```
purchase_behaviour.isna().sum()
```

```
LYLTY_CARD_NBR      0
LIFESTAGE           0
PREMIUM_CUSTOMER    0
dtype: int64
```

```
purchase_behaviour.isnull()
```

```
       LYLTY_CARD_NBR  LIFESTAGE  PREMIUM_CUSTOMER
0               False      False             False
1               False      False             False
2               False      False             False
3               False      False             False
4               False      False             False
...               ...        ...               ...
72632           False      False             False
72633           False      False             False
72634           False      False             False
72635           False      False             False
72636           False      False             False

[72637 rows x 3 columns]
```

```
purchase_behaviour.isnull().sum()
```

```
LYLTY_CARD_NBR      0
LIFESTAGE           0
PREMIUM_CUSTOMER    0
dtype: int64
```

```
purchase_behaviour.head(20)
```

```
    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
5             1007   YOUNG SINGLES/COUPLES           Budget
6             1009             NEW FAMILIES          Premium
7             1010   YOUNG SINGLES/COUPLES       Mainstream
8             1011   OLDER SINGLES/COUPLES       Mainstream
9             1012          OLDER FAMILIES       Mainstream
10            1013                 RETIREES           Budget
11            1016          OLDER FAMILIES       Mainstream
12            1018   YOUNG SINGLES/COUPLES       Mainstream
```

```
13            1019   OLDER SINGLES/COUPLES          Premium
14            1020   YOUNG SINGLES/COUPLES       Mainstream
15            1022          OLDER FAMILIES           Budget
16            1023  MIDAGE SINGLES/COUPLES          Premium
17            1024   YOUNG SINGLES/COUPLES          Premium
18            1025          YOUNG FAMILIES           Budget
19            1026  MIDAGE SINGLES/COUPLES          Premium
```

```
purchase_behaviour.tail(20)
```

```
       LYLTY_CARD_NBR               LIFESTAGE PREMIUM_CUSTOMER
72617         2330191   OLDER SINGLES/COUPLES           Budget
72618         2330211  MIDAGE SINGLES/COUPLES           Budget
72619         2330251                RETIREES           Budget
72620         2330271          YOUNG FAMILIES       Mainstream
72621         2330291   OLDER SINGLES/COUPLES       Mainstream
72622         2330311   YOUNG SINGLES/COUPLES           Budget
72623         2330321   YOUNG SINGLES/COUPLES       Mainstream
72624         2330331                RETIREES           Budget
72625         2330431   OLDER SINGLES/COUPLES       Mainstream
72626         2330461          OLDER FAMILIES           Budget
72627         2330501   OLDER SINGLES/COUPLES           Budget
72628         2370001   OLDER SINGLES/COUPLES          Premium
72629         2370181   YOUNG SINGLES/COUPLES       Mainstream
72630         2370361   OLDER SINGLES/COUPLES           Budget
72631         2370581   OLDER SINGLES/COUPLES           Budget
72632         2370651  MIDAGE SINGLES/COUPLES       Mainstream
72633         2370701          YOUNG FAMILIES       Mainstream
72634         2370751          YOUNG FAMILIES          Premium
72635         2370961          OLDER FAMILIES           Budget
72636         2373711   YOUNG SINGLES/COUPLES       Mainstream
```

```
purchase_behaviour.dtypes
```

```
LYLTY_CARD_NBR       int64
LIFESTAGE           object
PREMIUM_CUSTOMER    object
dtype: object
```

```
duplicated_purchases = purchase_behaviour.duplicated().sum()
duplicated_purchases
```

```
0
```

```
purchase_behaviour
```

```
       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
```

```
...              ...                         ...              ...
72632         2370651  MIDAGE SINGLES/COUPLES       Mainstream
72633         2370701          YOUNG FAMILIES       Mainstream
72634         2370751          YOUNG FAMILIES          Premium
72635         2370961          OLDER FAMILIES           Budget
72636         2373711   YOUNG SINGLES/COUPLES       Mainstream

[72637 rows x 3 columns]
```

```
customer_insights = transaction_data.merge(purchase_behaviour,
on='LYLTY_CARD_NBR', how='left')
customer_insights.head(10)
```

```
         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
5  2019-05-19          4            4074    2982        57
6  2019-05-16          4            4149    3333        16
7  2019-05-16          4            4196    3539        24
8  2018-08-20          5            5026    4525        42
9  2018-08-18          7            7150    6900        52

                                  PROD_NAME  PROD_QTY  TOT_SALES
non_chips
0    Natural Chip        Compny SeaSalt175g         2        6.0
False  \
1                  CCs Nacho Cheese    175g         3        6.3
True
2    Smiths Crinkle Cut  Chips Chicken 170g         2        2.9
False
3    Smiths Chip Thinly  S/Cream&Onion 175g         5       15.0
False
4  Kettle Tortilla ChpsHny&Jlpno Chili 150g         3       13.8
False
5  Old El Paso Salsa   Dip Tomato Mild 300g         1        5.1
True
6  Smiths Crinkle Chips Salt & Vinegar 330g         1        5.7
False
7     Grain Waves         Sweet Chilli 210g         1        3.6
True
8   Doritos Corn Chip Mexican Jalapeno 150g         1        3.9
False
9     Grain Waves Sour    Cream&Chives 210G         2        7.2
True

                LIFESTAGE PREMIUM_CUSTOMER
0   YOUNG SINGLES/COUPLES          Premium
```

```
1  MIDAGE SINGLES/COUPLES           Budget
2  MIDAGE SINGLES/COUPLES           Budget
3  MIDAGE SINGLES/COUPLES           Budget
4  MIDAGE SINGLES/COUPLES           Budget
5  MIDAGE SINGLES/COUPLES           Budget
6  MIDAGE SINGLES/COUPLES           Budget
7  MIDAGE SINGLES/COUPLES           Budget
8  MIDAGE SINGLES/COUPLES           Budget
9  MIDAGE SINGLES/COUPLES           Budget
```

```
customer_insights.drop(index=69762, inplace=True)
customer_insights
```

```
              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
...            ...        ...             ...     ...       ...
264831  2019-03-09        272          272319  270088        89
264832  2018-08-13        272          272358  270154        74
264833  2018-11-06        272          272379  270187        51
264834  2018-12-27        272          272379  270188        42
264835  2018-09-22        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
```

```
        non_chips               LIFESTAGE PREMIUM_CUSTOMER
0           False   YOUNG SINGLES/COUPLES          Premium
1            True  MIDAGE SINGLES/COUPLES           Budget
2           False  MIDAGE SINGLES/COUPLES           Budget
3           False  MIDAGE SINGLES/COUPLES           Budget
4           False  MIDAGE SINGLES/COUPLES           Budget
...           ...                     ...              ...
264831       True   YOUNG SINGLES/COUPLES          Premium
264832       True   YOUNG SINGLES/COUPLES          Premium
264833       True   YOUNG SINGLES/COUPLES          Premium
264834      False   YOUNG SINGLES/COUPLES          Premium
264835       True   YOUNG SINGLES/COUPLES          Premium

[264834 rows x 11 columns]
```

```
customer_insights.isnull().sum()
```

```
DATE                0
STORE_NBR           0
LYLTY_CARD_NBR      0
TXN_ID              0
PROD_NBR            0
PROD_NAME           0
PROD_QTY            0
TOT_SALES           0
non_chips           0
LIFESTAGE           0
PREMIUM_CUSTOMER    0
dtype: int64
```

```
customer_insights.to_csv('customer_insights.csv', index=False)

#Data Analysis begins here:

popular_customers = customer_insights.sort_values('TOT_SALES',
ascending = False)
popular_customers.head(15)
```

```
              DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR
55558   2019-05-14        190          190113  190914        14  \
5179    2018-08-15         94           94148   93390        14
117850  2019-05-19        194          194308  194516        14
150683  2019-05-20        118          118021  120799        14
184969  2019-05-20         44           44350   40394        14
69496   2018-08-15         49           49303   45789        14
171815  2018-08-17         24           24095   20797        14
81110   2018-08-17        181          181129  183109        23
```

```
135445  2018-08-14        154          154199  154279        20
17110   2018-08-16        172          172239  174254         7
117917  2018-08-18        221          221184  220787        16
204362  2018-08-20        222          222005  221532         7
117918  2019-05-20        221          221351  221349        23
72      2018-08-19         96           96203   96025         7
135346  2018-08-15        101          101110  100677        16

                                      PROD_NAME  PROD_QTY  TOT_SALES

55558     Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5
\
5179      Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

117850    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

150683    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

184969    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

69496     Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

171815    Smiths Crnkle Chip  Orgnl Big Bag 380g         5       29.5

81110                      Cheezels Cheese 330g         5       28.5

135445          Doritos Cheese      Supreme 330g         5       28.5

17110          Smiths Crinkle      Original 330g         5       28.5

117917  Smiths Crinkle Chips Salt & Vinegar 330g         5       28.5

204362         Smiths Crinkle      Original 330g         5       28.5

117918                     Cheezels Cheese 330g         5       28.5

72             Smiths Crinkle      Original 330g         5       28.5

135346  Smiths Crinkle Chips Salt & Vinegar 330g         5       28.5


        non_chips               LIFESTAGE PREMIUM_CUSTOMER
55558       False          OLDER FAMILIES       Mainstream
5179        False  MIDAGE SINGLES/COUPLES       Mainstream
117850      False   OLDER SINGLES/COUPLES          Premium
150683      False                RETIREES       Mainstream
184969      False          YOUNG FAMILIES           Budget
69496       False          OLDER FAMILIES          Premium
```

```
171815      False                RETIREES          Premium
81110        True   OLDER SINGLES/COUPLES           Budget
135445       True                RETIREES           Budget
17110        True  MIDAGE SINGLES/COUPLES          Premium
117917      False   OLDER SINGLES/COUPLES          Premium
204362       True          YOUNG FAMILIES       Mainstream
117918       True   OLDER SINGLES/COUPLES          Premium
72           True  MIDAGE SINGLES/COUPLES           Budget
135346      False                RETIREES           Budget
```

```
#find the sales in chips per brand
chips_sales_distribution =
customer_insights[customer_insights['non_chips'] ==
False].groupby('PROD_NAME')
['TOT_SALES'].sum().sort_values(ascending=False)
chips_sales_distribution.head(20)
```

```
PROD_NAME
Dorito Corn Chp     Supreme 380g            39052.0
Smiths Crnkle Chip  Orgnl Big Bag 380g      36367.6
Smiths Crinkle Chips Salt & Vinegar 330g    34804.2
Kettle Tortilla ChpsHny&Jlpno Chili 150g    29021.4
Kettle Tortilla ChpsBtroot&Ricotta 150g     27770.2
Kettle Tortilla ChpsFeta&Garlic 150g        27627.6
Doritos Corn Chips  Cheese Supreme 170g     27183.2
Doritos Corn Chips  Nacho Cheese 170g       26562.8
Tostitos Smoked     Chipotle 175g           26474.8
Doritos Corn Chips  Original 170g           26228.4
Tyrrells Crisps     Ched & Chives 165g      26149.2
Tyrrells Crisps     Lightly Salted 165g     25498.2
Doritos Corn Chip Mexican Jalapeno 150g     23887.5
Cobs Popd Sea Salt  Chips 110g              23852.6
Cobs Popd Swt/Chlli &Sr/Cream Chips 110g    23772.8
Doritos Corn Chip Southern Chicken 150g     23735.4
Infuzions Thai SweetChili PotatoMix 110g    23582.8
Cobs Popd Sour Crm  &Chives Chips 110g      22944.4
Pringles Original   Crisps 134g             22355.4
Thins Potato Chips  Hot & Spicy 175g        20410.5
Name: TOT_SALES, dtype: float64
```

```
# Here we can find that the most bought chips brand is the 'Dorito
Corn Chp Supreme 380g'
most_bought_chips = customer_insights[customer_insights['non_chips']
== False].groupby('PROD_NAME')['TOT_SALES'].sum().idxmax()
most_bought_chips
```

```
'Dorito Corn Chp     Supreme 380g'
```

```
life_stage_df = customer_insights[customer_insights['non_chips'] ==
False].groupby('LIFESTAGE')
```

```
['TOT_SALES'].sum().sort_values(ascending=False).head(20)
life_stage_df
```

```
LIFESTAGE
OLDER SINGLES/COUPLES     155045.25
RETIREES                  140110.50
OLDER FAMILIES            134365.70
YOUNG FAMILIES            121552.70
YOUNG SINGLES/COUPLES     100826.10
MIDAGE SINGLES/COUPLES     71048.60
NEW FAMILIES               19372.65
Name: TOT_SALES, dtype: float64
```

```
#here we see that old singles or couples spend more on chips than
other lifestage groups

# we may then choose to look further to find the most purchased chips
brand per lifestage

chips_customers = customer_insights[customer_insights['non_chips'] ==
False]

most_bought_per_lifestage = chips_customers[['LIFESTAGE', 'PROD_NAME',
'TOT_SALES']].groupby('LIFESTAGE').sum()
most_bought_per_lifestage.sort_values('TOT_SALES',
ascending=False).head(20)

# from the analysis, we can see which chips category is popular for
each lifestage.
```

```
PROD_NAME
LIFESTAGE

OLDER SINGLES/COUPLES   WW Original Corn    Chips 200gDoritos Corn
Chi...  \
RETIREES                Sunbites Whlegrn    Crisps Frch/Onin
90gSmiths...
OLDER FAMILIES          Smiths Crinkle Chips Salt & Vinegar
330gKettle...
YOUNG FAMILIES          Thins Chips Salt &  Vinegar 175gDoritos Corn
C...
YOUNG SINGLES/COUPLES   Natural Chip        Compny
SeaSalt175gTostitos...
MIDAGE SINGLES/COUPLES  Smiths Crinkle Cut  Chips Chicken 170gSmiths
C...
NEW FAMILIES            Kettle Tortilla ChpsFeta&Garlic 150gSmiths
Crn...

                        TOT_SALES
```

```
LIFESTAGE
OLDER SINGLES/COUPLES   155045.25
RETIREES                140110.50
OLDER FAMILIES          134365.70
YOUNG FAMILIES          121552.70
YOUNG SINGLES/COUPLES   100826.10
MIDAGE SINGLES/COUPLES   71048.60
NEW FAMILIES             19372.65
```

```
# We can also find out how many customers are in each customer
segment.

chips_customers = customer_insights[customer_insights['non_chips'] ==
False]

most_bought_per_premium =
chips_customers['PREMIUM_CUSTOMER'].value_counts()
most_bought_per_premium.sort_values(ascending=False).head(10)

# We find out that there 39840 mainstream, 36275 budget and 27067
premium chips customers
```

```
PREMIUM_CUSTOMER
Mainstream    39840
Budget        36275
Premium       27067
Name: count, dtype: int64
```

```
# To find out the number of chips bought per customer segment
chips_customers = customer_insights[customer_insights['non_chips'] ==
False]

no_of_chips_per_customer_segment =
chips_customers.groupby('PREMIUM_CUSTOMER')
['PROD_QTY'].sum().sort_values(ascending=False).head(20)
no_of_chips_per_customer_segment

# mainstream customers bought 75842 chips, Budget customers 69243
chips and Premium customers 51618 chips.
```

```
PREMIUM_CUSTOMER
Mainstream    75842
Budget        69243
Premium       51618
Name: PROD_QTY, dtype: int64
```

```
customer_insights['PACK_PRICE'] = customer_insights['TOT_SALES'] /
customer_insights['PROD_QTY']
customer_insights
```

```
             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
...            ...        ...             ...     ...       ...
264831  2019-03-09        272          272319  270088        89
264832  2018-08-13        272          272358  270154        74
264833  2018-11-06        272          272379  270187        51
264834  2018-12-27        272          272379  270188        42
264835  2018-09-22        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


        non_chips               LIFESTAGE PREMIUM_CUSTOMER  PACK_PRICE

0           False   YOUNG SINGLES/COUPLES          Premium        3.00

1            True  MIDAGE SINGLES/COUPLES           Budget        2.10

2           False  MIDAGE SINGLES/COUPLES           Budget        1.45

3           False  MIDAGE SINGLES/COUPLES           Budget        3.00
```

```
4           False  MIDAGE SINGLES/COUPLES           Budget        4.60

...           ...                     ...              ...         ...

264831       True   YOUNG SINGLES/COUPLES          Premium        5.40

264832       True   YOUNG SINGLES/COUPLES          Premium        4.40

264833       True   YOUNG SINGLES/COUPLES          Premium        4.40

264834      False   YOUNG SINGLES/COUPLES          Premium        3.90

264835       True   YOUNG SINGLES/COUPLES          Premium        4.40


[264834 rows x 12 columns]
```

```
customer_chips = customer_insights[customer_insights['non_chips'] ==
False ]

average_chips_sales =
pd.DataFrame(customer_chips.groupby('PREMIUM_CUSTOMER')
['PACK_PRICE'].sum())
average_chips_sales.rename(columns={'PACK_PRICE':'TOTAL_CHIPS_SALES'},
inplace=True)
average_chips_sales
```

```
                  TOTAL_CHIPS_SALES
PREMIUM_CUSTOMER
Budget                    135460.02
Mainstream                151986.55
Premium                   101401.35
```

```
average_chips_sales['UNITS_SOLD'] =
chips_customers.groupby('PREMIUM_CUSTOMER')['PROD_QTY'].sum()
average_chips_sales
```

```
                  TOTAL_CHIPS_SALES  UNITS_SOLD
PREMIUM_CUSTOMER
Budget                    135460.02       69243
Mainstream                151986.55       75842
Premium                   101401.35       51618
```

```
average_chips_sales['AVERAGE_PRICE'] =
average_chips_sales['TOTAL_CHIPS_SALES'] /
average_chips_sales['UNITS_SOLD']
average_chips_sales
```

```
                  TOTAL_CHIPS_SALES  UNITS_SOLD  AVERAGE_PRICE
PREMIUM_CUSTOMER
Budget                    135460.02       69243       1.956299
```

```
Mainstream                151986.55       75842       2.003989
Premium                   101401.35       51618       1.964457
```

```
# The average price for chips in the Budget customers category is
$1.95 while the Mainstream customers average
# price for chips is $2.00. The premium customers pay an average or $
1.96 for each chips sachet.

# The analysis and visualization above indicates the distribution of
highest spending customers per customer group
# we may therefore conclude that, the highest spenders per premium
group are older families, retirees and old singles
# furthermore, the same lifestages are also the highest spenders in
the budget group. There is a slight variation in
# the mainstream group where we notice young singles have a
significantly larger number of members.

# To find an individual customers sales for all products
customer_salesDF =
pd.DataFrame(customer_insights.groupby('LYLTY_CARD_NBR')
['TOT_SALES'].sum().sort_values(ascending=False))
customer_salesDF
```

```
                TOT_SALES
LYLTY_CARD_NBR
230078              138.6
63197               132.8
259009              127.2
162039              126.8
58361               124.8
...                   ...
151175                1.5
41089                 1.5
169206                1.5
136282                1.5
266092                1.5

[72636 rows x 1 columns]
```

```
# To find the chips sales for an individual customer
chips_salesDF =
pd.DataFrame(customer_insights[customer_insights['non_chips'] ==
False].groupby('LYLTY_CARD_NBR')
['TOT_SALES'].sum().sort_values(ascending=False))
chips_salesDF
```

```
                TOT_SALES
LYLTY_CARD_NBR
58361                83.2
88105                82.8
69154                79.6
```

```
28020               78.4
210110              70.7
...                  ...
18233                1.7
214228               1.7
35261                1.7
256162               1.7
6040                 1.7

[51949 rows x 1 columns]
```

```
# customer sales merged with chips sales
chips_customer_sales = chips_salesDF.merge(customer_salesDF,
on='LYLTY_CARD_NBR', how='left', suffixes=('_CHIPS', '_OTHER_ITEMS'))
chips_customer_sales.sort_values(['TOT_SALES_CHIPS',
'TOT_SALES_OTHER_ITEMS'], ascending=False)
```

```
                TOT_SALES_CHIPS  TOT_SALES_OTHER_ITEMS
LYLTY_CARD_NBR
58361                      83.2                 124.8
88105                      82.8                 108.8
69154                      79.6                 109.6
28020                      78.4                 115.6
210110                     70.7                  85.3
...                         ...                   ...
248125                      1.7                   1.7
176262                      1.7                   1.7
35261                       1.7                   1.7
256162                      1.7                   1.7
6040                        1.7                   1.7

[51949 rows x 2 columns]
```

```
# To find how much customers spend on chips against their total
expenditure

chips_customer_sales['PPN_SPENT_ON_CHIPS'] =
chips_customer_sales['TOT_SALES_CHIPS'] /
chips_customer_sales['TOT_SALES_OTHER_ITEMS']
chips_customer_sales.sort_values('PPN_SPENT_ON_CHIPS', ascending=True)
```

```
                TOT_SALES_CHIPS  TOT_SALES_OTHER_ITEMS
PPN_SPENT_ON_CHIPS
LYLTY_CARD_NBR

180050                      1.7                  47.7
0.035639
93217                       1.7                  44.5
0.038202
28073                       1.7                  39.1
0.043478
```

```
241093                      3.8                  86.8
0.043779
259055                      3.4                  75.4
0.045093
...                         ...                   ...
...
41348                      13.0                  13.0
1.000000
149174                     13.0                  13.0
1.000000
29117                      13.0                  13.0
1.000000
255287                      6.6                   6.6
1.000000
6040                        1.7                   1.7
1.000000

[51949 rows x 3 columns]
```

```
non_chips_customers = customer_insights[customer_insights['non_chips']
== True]
non_chips_customers
```

```
              DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR
1       2019-05-14          1            1307     348        66  \
5       2019-05-19          4            4074    2982        57
7       2019-05-16          4            4196    3539        24
9       2018-08-18          7            7150    6900        52
11      2018-08-20          8            8294    8221       114
...            ...        ...             ...     ...       ...
264829  2019-03-16        272          272236  269976        49
264831  2019-03-09        272          272319  270088        89
264832  2018-08-13        272          272358  270154        74
264833  2018-11-06        272          272379  270187        51
264835  2018-09-22        272          272380  270189        74

                                       PROD_NAME  PROD_QTY  TOT_SALES

1                      CCs Nacho Cheese    175g         3        6.3
\
5       Old El Paso Salsa   Dip Tomato Mild 300g         1        5.1

7          Grain Waves         Sweet Chilli 210g         1        3.6

9          Grain Waves Sour    Cream&Chives 210G         2        7.2

11         Kettle Sensations   Siracha Lime 150g         5       23.0

...                                          ...       ...        ...
```

```
264829  Infuzions SourCream&Herbs Veg Strws 110g         2        7.6
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
264835             Tostitos Splash Of  Lime 175g         2        8.8

        non_chips               LIFESTAGE PREMIUM_CUSTOMER  PACK_PRICE
1            True  MIDAGE SINGLES/COUPLES           Budget         2.1
5            True  MIDAGE SINGLES/COUPLES           Budget         5.1
7            True  MIDAGE SINGLES/COUPLES           Budget         3.6
9            True  MIDAGE SINGLES/COUPLES           Budget         3.6
11           True  MIDAGE SINGLES/COUPLES           Budget         4.6
...           ...                     ...              ...         ...
264829       True   YOUNG SINGLES/COUPLES          Premium         3.8
264831       True   YOUNG SINGLES/COUPLES          Premium         5.4
264832       True   YOUNG SINGLES/COUPLES          Premium         4.4
264833       True   YOUNG SINGLES/COUPLES          Premium         4.4
264835       True   YOUNG SINGLES/COUPLES          Premium         4.4

[161652 rows x 12 columns]
```

```
all_customersDF =
pd.DataFrame(customer_insights['PREMIUM_CUSTOMER'].value_counts())
all_customersDF
```

```
                   count
PREMIUM_CUSTOMER
Mainstream        101988
Budget             93157
Premium            69689
```

```
chips_customersDF =
pd.DataFrame(chips_customers['PREMIUM_CUSTOMER'].value_counts())
chips_customersDF
```

```
                   count
PREMIUM_CUSTOMER
Mainstream         39840
Budget             36275
Premium            27067
```

```
chips_vs_allcustomers = chips_customersDF.merge(all_customersDF, on =
'PREMIUM_CUSTOMER', suffixes=('_CHIPS_CUSTOMERS', '_ALL_CUSTOMERS'))
chips_vs_allcustomers
```

```
                   count_CHIPS_CUSTOMERS  count_ALL_CUSTOMERS
PREMIUM_CUSTOMER
Mainstream                         39840               101988
Budget                             36275                93157
Premium                            27067                69689
```

```
chips_vs_allcustomers['PROPORTION_OF_CHIPS_CSTMR}'] =
chips_vs_allcustomers['count_CHIPS_CUSTOMERS'] /
chips_vs_allcustomers['count_ALL_CUSTOMERS'] * 100
chips_vs_allcustomers
```

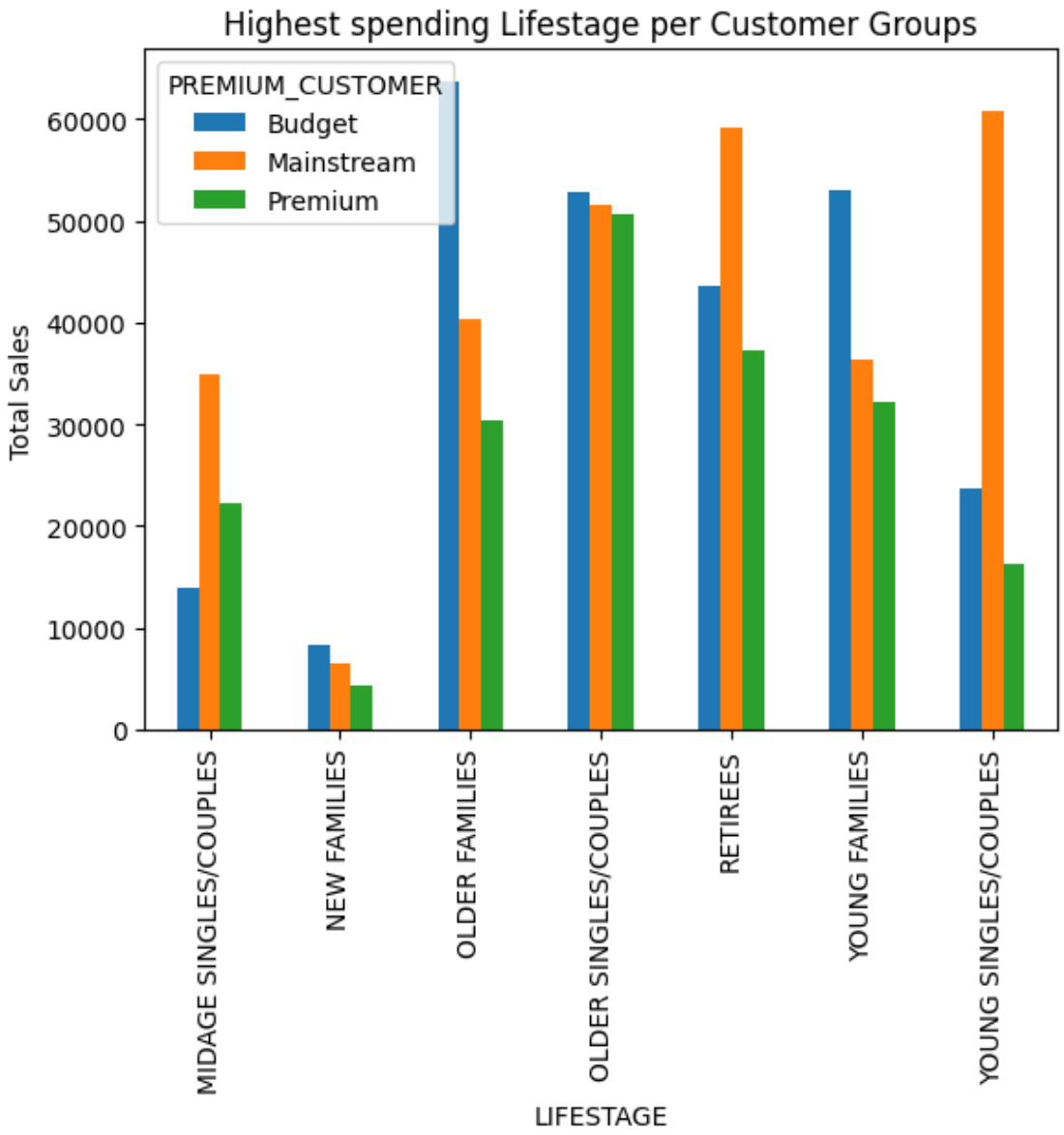
```
                   count_CHIPS_CUSTOMERS  count_ALL_CUSTOMERS
PREMIUM_CUSTOMER
Mainstream                         39840               101988  \
Budget                             36275                93157
Premium                            27067                69689

                   PROPORTION_OF_CHIPS_CSTMR}
PREMIUM_CUSTOMER
Mainstream                          39.063419
Budget                              38.939640
Premium                             38.839702
```

```
# From the mainstream customers, 39.06% purchased chips, 38.94% of the
Budget customers purchased chips
# and 38.83% of the Premium customers purchased chips.

# This is the total sales per premium group and lifestage

total_sales_life_prem = chips_customers[['LIFESTAGE',
'PREMIUM_CUSTOMER', 'TOT_SALES']].groupby(['PREMIUM_CUSTOMER',
'LIFESTAGE'])['TOT_SALES'].sum()
total_sales_life_prem
```

```
PREMIUM_CUSTOMER  LIFESTAGE
Budget            MIDAGE SINGLES/COUPLES    13937.80
                  NEW FAMILIES               8406.85
                  OLDER FAMILIES            63684.05
```

```
                    OLDER SINGLES/COUPLES     52735.10
                    RETIREES                  43578.20
                    YOUNG FAMILIES            53062.05
                    YOUNG SINGLES/COUPLES     23723.90
Mainstream          MIDAGE SINGLES/COUPLES    34886.85
                    NEW FAMILIES               6571.00
                    OLDER FAMILIES            40259.15
                    OLDER SINGLES/COUPLES     51638.40
                    RETIREES                  59178.55
                    YOUNG FAMILIES            36273.05
                    YOUNG SINGLES/COUPLES     60805.40
Premium             MIDAGE SINGLES/COUPLES    22223.95
                    NEW FAMILIES               4394.80
                    OLDER FAMILIES            30422.50
                    OLDER SINGLES/COUPLES     50671.75
                    RETIREES                  37353.75
                    YOUNG FAMILIES            32217.60
                    YOUNG SINGLES/COUPLES     16296.80
Name: TOT_SALES, dtype: float64
```

```
pivot_data = total_sales_life_prem.unstack(level=0)

ax = pivot_data.plot(kind='bar')

ax.set_xlabel('LIFESTAGE')
ax.set_ylabel('Total Sales')
ax.set_title('Highest spending Lifestage per Customer Groups')
ax.legend(title='PREMIUM_CUSTOMER')

plt.xticks(rotation=90)

plt.show()
```

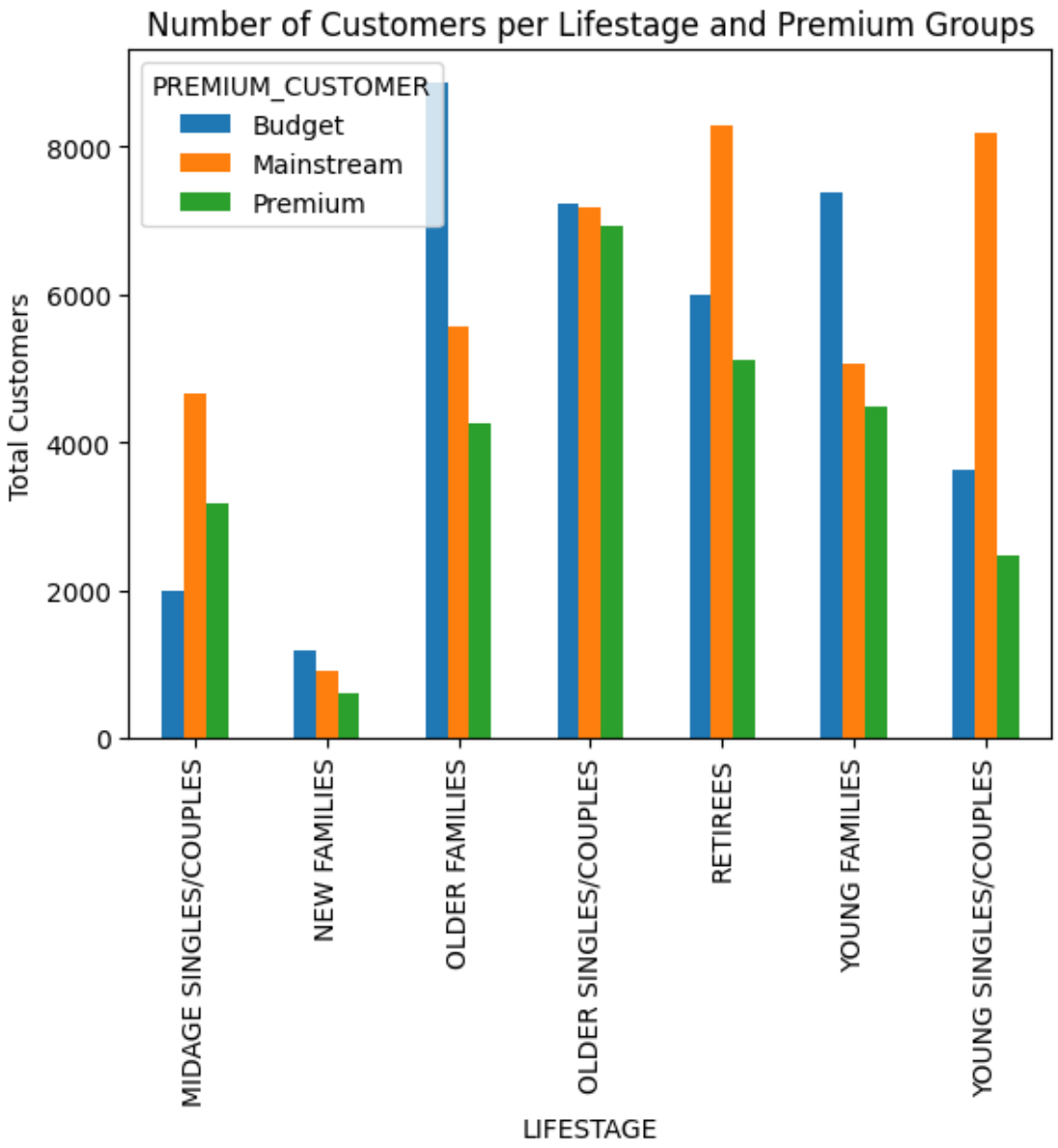



```
# To find the total number of customers per premium group and
lifestage
total_customers_life_prem = chips_customers[['LIFESTAGE',
'PREMIUM_CUSTOMER']].groupby('PREMIUM_CUSTOMER').value_counts()
total_customers_life_prem
```

```
PREMIUM_CUSTOMER  LIFESTAGE
Budget            OLDER FAMILIES            8865
                  YOUNG FAMILIES            7386
                  OLDER SINGLES/COUPLES     7236
                  RETIREES                  5988
                  YOUNG SINGLES/COUPLES     3627
                  MIDAGE SINGLES/COUPLES    1990
                  NEW FAMILIES              1183
Mainstream        RETIREES                  8294
```

```
                    YOUNG SINGLES/COUPLES     8181
                    OLDER SINGLES/COUPLES     7168
                    OLDER FAMILIES            5569
                    YOUNG FAMILIES            5071
                    MIDAGE SINGLES/COUPLES    4650
                    NEW FAMILIES               907
Premium             OLDER SINGLES/COUPLES     6931
                    RETIREES                  5119
                    YOUNG FAMILIES            4486
                    OLDER FAMILIES            4268
                    MIDAGE SINGLES/COUPLES    3172
                    YOUNG SINGLES/COUPLES     2477
                    NEW FAMILIES               614
Name: count, dtype: int64
```

```python
pivot_data = total_customers_life_prem.unstack(level=0)

ax = pivot_data.plot(kind='bar')

ax.set_xlabel('LIFESTAGE')
ax.set_ylabel('Total Customers')
ax.set_title('Number of Customers per Lifestage and Premium Groups')
ax.legend(title='PREMIUM_CUSTOMER')

plt.xticks(rotation=90)

plt.show()
```

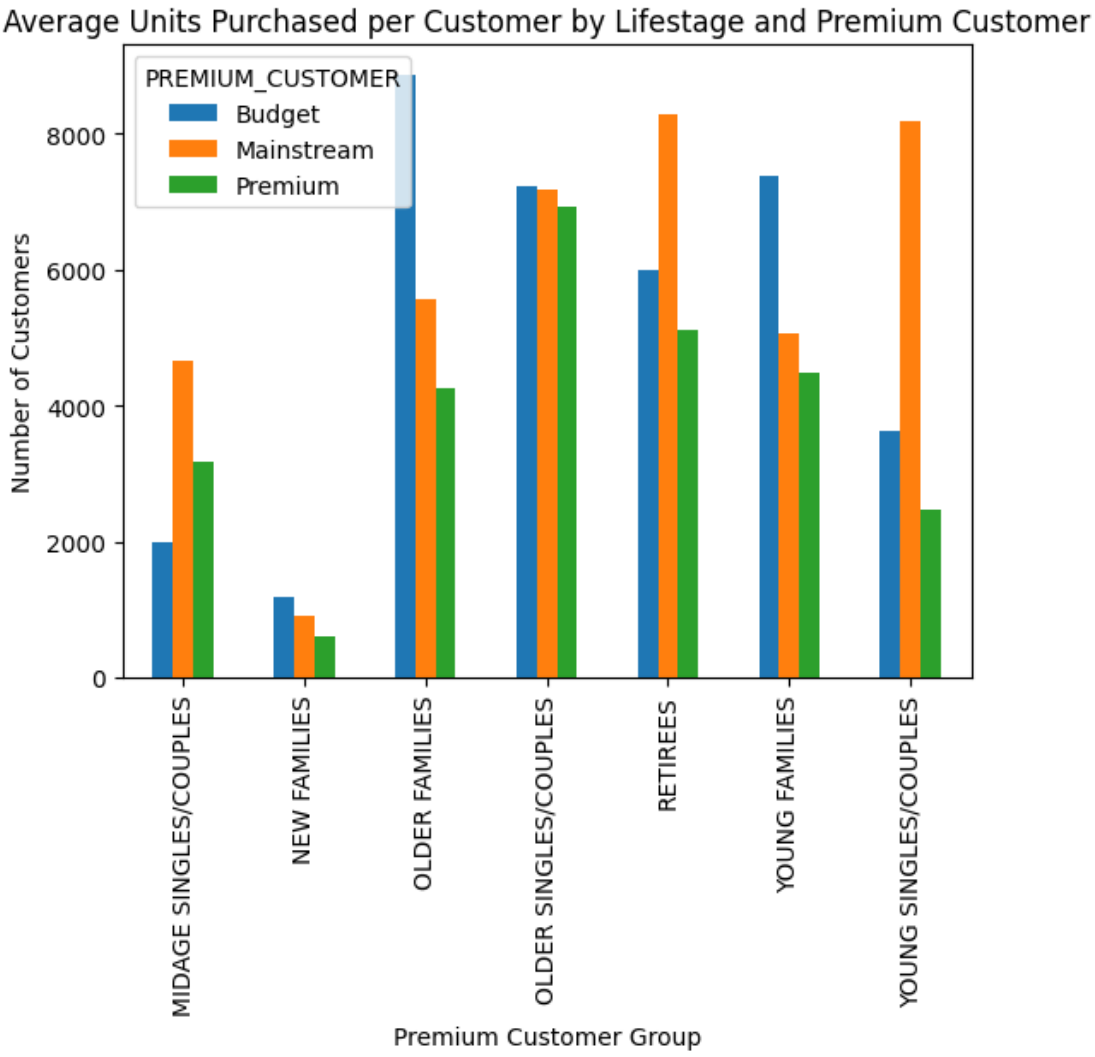



```
## to find the average Units purchased per customer by lifestage and
premium customer
average_units_per_customer_prem_lifestage =
chips_customers[['LIFESTAGE', 'PREMIUM_CUSTOMER', 'PROD_QTY',
'LYLTY_CARD_NBR']].groupby(['PREMIUM_CUSTOMER', 'LIFESTAGE',
'LYLTY_CARD_NBR'])['PROD_QTY'].mean()
average_units_per_customer_prem_lifestage
```

```
PREMIUM_CUSTOMER  LIFESTAGE               LYLTY_CARD_NBR
Budget            MIDAGE SINGLES/COUPLES  1052             1.0
                                          1081             1.5
                                          1184             1.0
                                          1307             2.0
                                          1343             2.0
```

```
                                                                  ...
Premium           YOUNG SINGLES/COUPLES   272193            1.0
                                          272194            2.0
                                          272197            2.0
                                          272319            2.0
                                          272379            2.0
Name: PROD_QTY, Length: 51949, dtype: float64
```

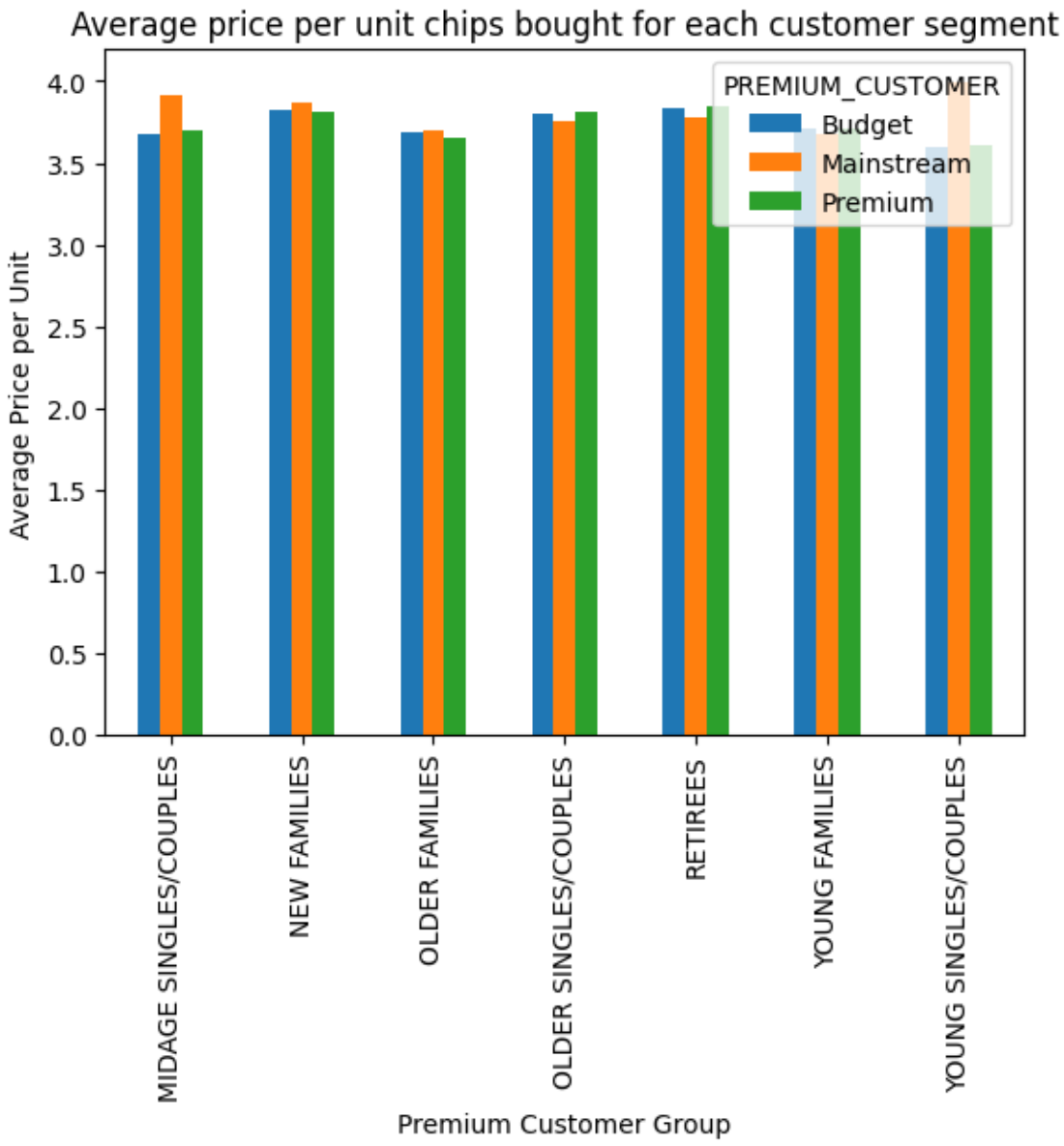
```
pivot_data = total_customers_life_prem.unstack(level=0)

ax = pivot_data.plot(kind='bar')

ax.set_xlabel('Premium Customer Group')
ax.set_ylabel('Number of Customers')
ax.set_title('Average Units Purchased per Customer by Lifestage and
Premium Customer')
ax.legend(title='PREMIUM_CUSTOMER')

plt.xticks(rotation=90)

plt.show()
```




```
# Here we want to find the average price per unit chips bought for
each customer
# segment as this is also a driver of total sales

average_price_per_unit_premium_lifestage =
customer_chips[['LIFESTAGE', 'PREMIUM_CUSTOMER',
'PACK_PRICE']].groupby(['PREMIUM_CUSTOMER', 'LIFESTAGE'])
['PACK_PRICE'].mean()

average_price_per_unit_premium_lifestage

PREMIUM_CUSTOMER  LIFESTAGE
Budget            MIDAGE SINGLES/COUPLES    3.675704
                  NEW FAMILIES              3.826754
                  OLDER FAMILIES            3.689887
                  OLDER SINGLES/COUPLES     3.806226
                  RETIREES                  3.834294
                  YOUNG FAMILIES            3.704572
```

```
                    YOUNG SINGLES/COUPLES     3.596333
Mainstream          MIDAGE SINGLES/COUPLES    3.917118
                    NEW FAMILIES              3.871499
                    OLDER FAMILIES            3.701562
                    OLDER SINGLES/COUPLES     3.761119
                    RETIREES                  3.778569
                    YOUNG FAMILIES            3.681828
                    YOUNG SINGLES/COUPLES     3.994231
Premium             MIDAGE SINGLES/COUPLES    3.704540
                    NEW FAMILIES              3.811401
                    OLDER FAMILIES            3.654135
                    OLDER SINGLES/COUPLES     3.810807
                    RETIREES                  3.850645
                    YOUNG FAMILIES            3.713698
                    YOUNG SINGLES/COUPLES     3.605450
Name: PACK_PRICE, dtype: float64
```

```
pivot_data = average_price_per_unit_premium_lifestage.unstack(level=0)

ax = pivot_data.plot(kind='bar')

ax.set_xlabel('Premium Customer Group')
ax.set_ylabel('Average Price per Unit')
ax.set_title('Average price per unit chips bought for each customer
segment')
ax.legend(title='PREMIUM_CUSTOMER')

plt.xticks(rotation=90)

plt.show()
```




```
# T- Test Between mainstream and premium midage and young singles and
couple

# Data for the 'Mainstream' and 'Premium Midage' groups
working_group = customer_chips[['PREMIUM_CUSTOMER', 'LIFESTAGE',
'PACK_PRICE']]
premium_midage_group = working_group[(working_group['LIFESTAGE'] ==
'YOUNG SINGLES/COUPLES') | (working_group['LIFESTAGE'] == 'MIDAGE
SINGLES/COUPLES') & (working_group['PREMIUM_CUSTOMER'] == 'Premium')]
mainstream_midage_group = working_group[(working_group['LIFESTAGE'] ==
'YOUNG SINGLES/COUPLES') | (working_group['LIFESTAGE'] == 'MIDAGE
SINGLES/COUPLES') & (working_group['PREMIUM_CUSTOMER'] ==
'Mainstream')]
```

```
premium_data = premium_midage_group.groupby('LIFESTAGE')
['PACK_PRICE'].mean()

mainstream_data = mainstream_midage_group.groupby('LIFESTAGE')
['PACK_PRICE'].mean()


# # Performing the t-test between 'Mainstream' and 'Premium Midage'
t_statistic1, p_value1 = stats.ttest_ind(mainstream_data,
premium_data, equal_var=False)

print("T-Statistic: ", t_statistic1)
print("P-Value: ", p_value1)
```

```
T-Statistic:  1.4004100025446393
P-Value:  0.3050232785577799
```

```
# # T- Test Between mainstream and budget midage and young singles and
couple

# Data for the 'Mainstream' and 'Premium Midage' groups
working_group = customer_chips[['PREMIUM_CUSTOMER', 'LIFESTAGE',
'PACK_PRICE']]
budget_midage_group = working_group[(working_group['LIFESTAGE'] ==
'YOUNG SINGLES/COUPLES') | (working_group['LIFESTAGE'] == 'MIDAGE
SINGLES/COUPLES') & (working_group['PREMIUM_CUSTOMER'] == 'Budget')]
mainstream_midage_group = working_group[(working_group['LIFESTAGE'] ==
'YOUNG SINGLES/COUPLES') | (working_group['LIFESTAGE'] == 'MIDAGE
SINGLES/COUPLES') & (working_group['PREMIUM_CUSTOMER'] ==
'Mainstream')]


budget_data = budget_midage_group.groupby('LIFESTAGE')
['PACK_PRICE'].mean()

mainstream_data = mainstream_midage_group.groupby('LIFESTAGE')
['PACK_PRICE'].mean()


# # Performing the t-test between 'Mainstream' and 'Premium Midage'
t_statistic1, p_value1 = stats.ttest_ind(mainstream_data, budget_data,
equal_var=False)

print("T-Statistic: ", t_statistic1)
print("P-Value: ", p_value1)
```

```
T-Statistic:  1.3741006908211104
P-Value:  0.32636378100490787
```

```
# The T-statistic in both tests is a positive value indicating that
the mean of the budget and premium average
# spending is greater than the mainstream customer's average spending.


# Our hypothesis in this case is: Is there a significant difference
between the average spending between
# the mainstream and premium midage and young singles and couple

# Our significance value is 0.05 degree of significance.
# Since out p-value is significantly higher than the degree of
significance we may choose to fail to reject
# our null hypothesis. This indicates that the difference in average
spending between the two group is not large.

customer_insights[['BRAND', 'PACK_SIZE']] =
customer_insights['PROD_NAME'].str.extract(r'([^\d]+)(\d+g)')
customer_insights

chips_customer = customer_insights[customer_insights['non_chips'] ==
False]
chips_customer
```

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	\
0	2018-10-17	1	1000	1	5	\
2	2019-05-20	1	1343	383	61	
3	2018-08-17	2	2373	974	69	
4	2018-08-18	2	2426	1038	108	
6	2019-05-16	4	4149	3333	16	
...	...	...	...	...	...	
264824	2019-03-13	272	272193	269906	9	
264826	2019-03-25	272	272194	269908	75	
264827	2018-08-28	272	272197	269911	104	
264830	2018-11-12	272	272319	270087	44	
264834	2018-12-27	272	272379	270188	42	

	PROD_NAME	PROD_QTY	TOT_SALES
0	Natural Chip Compny SeaSalt175g	2	6.0
\			
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
6	Smiths Crinkle Chips Salt & Vinegar 330g	1	5.7
...	...	...	...

```
264824   Kettle Tortilla ChpsBtroot&Ricotta 150g         1        4.6

264826            Cobs Popd Sea Salt  Chips 110g         2        7.6

264827  Infuzions Thai SweetChili PotatoMix 110g         2        7.6

264830            Thins Chips Light&  Tangy 175g         2        6.6

264834   Doritos Corn Chip Mexican Jalapeno 150g         2        7.8


        non_chips               LIFESTAGE PREMIUM_CUSTOMER  PACK_PRICE

0           False   YOUNG SINGLES/COUPLES          Premium        3.00
\
2           False  MIDAGE SINGLES/COUPLES           Budget        1.45

3           False  MIDAGE SINGLES/COUPLES           Budget        3.00

4           False  MIDAGE SINGLES/COUPLES           Budget        4.60

6           False  MIDAGE SINGLES/COUPLES           Budget        5.70

...           ...                     ...              ...         ...

264824      False   YOUNG SINGLES/COUPLES          Premium        4.60

264826      False   YOUNG SINGLES/COUPLES          Premium        3.80

264827      False   YOUNG SINGLES/COUPLES          Premium        3.80

264830      False   YOUNG SINGLES/COUPLES          Premium        3.30

264834      False   YOUNG SINGLES/COUPLES          Premium        3.90


                                      BRAND PACK_SIZE
0         Natural Chip        Compny SeaSalt      175g
2         Smiths Crinkle Cut  Chips Chicken       170g
3         Smiths Chip Thinly  S/Cream&Onion       175g
4       Kettle Tortilla ChpsHny&Jlpno Chili       150g
6       Smiths Crinkle Chips Salt & Vinegar       330g
...                                      ...       ...
264824   Kettle Tortilla ChpsBtroot&Ricotta       150g
264826            Cobs Popd Sea Salt  Chips       110g
264827  Infuzions Thai SweetChili PotatoMix       110g
264830            Thins Chips Light&  Tangy       175g
```

```
264834   Doritos Corn Chip Mexican Jalapeno       150g

[103182 rows x 14 columns]
```

```
young_single_couple_mainstream =
chips_customer[(customer_chips['PREMIUM_CUSTOMER'] == 'Mainstream') &
(chips_customer['LIFESTAGE'] == 'YOUNG SINGLES/COUPLES')]
young_single_couple_mainstream[['PROD_NAME',
'PROD_QTY']].groupby('PROD_NAME')
['PROD_QTY'].sum().sort_values(ascending=False)
```

```
PROD_NAME
Doritos Corn Chips  Cheese Supreme 170g     621
Kettle Tortilla ChpsHny&Jlpno Chili 150g    604
Smiths Crnkle Chip  Orgnl Big Bag 380g      596
Smiths Crinkle Chips Salt & Vinegar 330g    582
Tyrrells Crisps     Ched & Chives 165g      580
Infuzions Thai SweetChili PotatoMix 110g    576
Doritos Corn Chips  Original 170g           573
Dorito Corn Chp     Supreme 380g            569
Tyrrells Crisps     Lightly Salted 165g     563
Cobs Popd Sour Crm  &Chives Chips 110g      556
Doritos Corn Chips  Nacho Cheese 170g       549
Cobs Popd Swt/Chlli &Sr/Cream Chips 110g    547
Kettle Tortilla ChpsFeta&Garlic 150g        547
Thins Potato Chips  Hot & Spicy 175g        546
Doritos Corn Chip Mexican Jalapeno 150g     542
Pringles Original   Crisps 134g             538
Kettle Tortilla ChpsBtroot&Ricotta 150g     524
Tostitos Smoked     Chipotle 175g           518
Cobs Popd Sea Salt  Chips 110g              514
Thins Chips Seasonedchicken 175g            505
Doritos Corn Chip Southern Chicken 150g     505
Thins Chips Light&  Tangy 175g              500
Thins Chips Salt &  Vinegar 175g            474
Thins Chips         Originl saltd 175g      162
Natural ChipCo Sea  Salt & Vinegr 175g      159
Natural Chip        Compny SeaSalt175g      148
French Fries Potato Chips 175g              143
Natural Chip Co     Tmato Hrb&Spce 175g     142
Smiths Chip Thinly  Cut Original 175g       140
Smiths Crinkle Cut  Chips Chs&Onion170g     139
Smiths Crinkle Cut  Chips Barbecue 170g     137
Smiths Crinkle Cut  Chips Original 170g     131
Natural ChipCo      Hony Soy Chckn175g      129
Snbts Whlgrn Crisps Cheddr&Mstrd 90g        126
Smiths Chip Thinly  S/Cream&Onion 175g      123
WW Original Stacked Chips 160g              118
WW Supreme Cheese   Corn Chips 200g         116
WW Sour Cream &OnionStacked Chips 160g      114
```

```
Smiths Chip Thinly  CutSalt/Vinegr175g      112
Smiths Crinkle Cut  Chips Chicken 170g      109
WW Original Corn    Chips 200g              106
Sunbites Whlegrn    Crisps Frch/Onin 90g    104
WW D/Style Chip     Sea Salt 200g           103
Name: PROD_QTY, dtype: int64
```

```
# INSIGHTS: young singles from the mainstream customer segment prefer
Dorito corn chips more than other brands
```

```
customers_buy_chips = customer_insights[customer_insights['non_chips']
== False]
prefered_chips_size = customers_buy_chips[['PROD_NAME',
'PACK_SIZE']].groupby('PACK_SIZE').value_counts()
prefered_chips_size.sort_values(ascending=False)
```

```
PACK_SIZE  PROD_NAME
150g       Kettle Tortilla ChpsHny&Jlpno Chili 150g    3296
110g       Cobs Popd Swt/Chlli &Sr/Cream Chips 110g    3269
165g       Tyrrells Crisps     Ched & Chives 165g      3268
110g       Cobs Popd Sea Salt  Chips 110g              3265
           Infuzions Thai SweetChili PotatoMix 110g    3242
380g       Smiths Crnkle Chip  Orgnl Big Bag 380g      3233
175g       Thins Potato Chips  Hot & Spicy 175g        3229
170g       Doritos Corn Chips  Cheese Supreme 170g     3217
150g       Doritos Corn Chip Mexican Jalapeno 150g     3204
330g       Smiths Crinkle Chips Salt & Vinegar 330g    3197
175g       Thins Chips Light&  Tangy 175g              3188
380g       Dorito Corn Chp     Supreme 380g            3183
165g       Tyrrells Crisps     Lightly Salted 165g     3174
150g       Doritos Corn Chip Southern Chicken 150g     3172
170g       Doritos Corn Chips  Nacho Cheese 170g       3160
110g       Cobs Popd Sour Crm  &Chives Chips 110g      3159
134g       Pringles Original   Crisps 134g             3157
150g       Kettle Tortilla ChpsBtroot&Ricotta 150g     3146
175g       Tostitos Smoked     Chipotle 175g           3145
150g       Kettle Tortilla ChpsFeta&Garlic 150g        3138
170g       Doritos Corn Chips  Original 170g          3121
175g       Thins Chips Seasonedchicken 175g            3114
           Thins Chips Salt &  Vinegar 175g            3103
           Smiths Chip Thinly  Cut Original 175g       1614
90g        Snbts Whlgrn Crisps Cheddr&Mstrd 90g        1576
175g       Natural Chip Co     Tmato Hrb&Spce 175g     1572
           Natural ChipCo Sea  Salt & Vinegr 175g      1550
200g       WW Supreme Cheese   Corn Chips 200g         1509
           WW Original Corn    Chips 200g              1495
170g       Smiths Crinkle Cut  Chips Barbecue 170g     1489
160g       WW Original Stacked Chips 160g              1487
170g       Smiths Crinkle Cut  Chips Chicken 170g      1484
```

```
160g       WW Sour Cream &OnionStacked Chips 160g      1483
170g       Smiths Crinkle Cut  Chips Chs&Onion170g     1481
175g       Smiths Chip Thinly  S/Cream&Onion 175g      1473
200g       WW D/Style Chip     Sea Salt 200g           1469
175g       Natural Chip        Compny SeaSalt175g      1468
170g       Smiths Crinkle Cut  Chips Original 170g     1461
175g       Natural ChipCo      Hony Soy Chckn175g      1460
           Thins Chips         Originl saltd 175g      1441
           Smiths Chip Thinly  CutSalt/Vinegr175g      1440
90g        Sunbites Whlegrn    Crisps Frch/Onin 90g    1432
175g       French Fries Potato Chips 175g              1418
Name: count, dtype: int64
```

```
young_single_couple_mainstream_size_preference =
young_single_couple_mainstream[['PROD_NAME',
'PACK_SIZE']].groupby('PACK_SIZE').value_counts()
young_single_couple_mainstream_size_preference.sort_values(ascending=F
alse)
```

```
PACK_SIZE  PROD_NAME
170g       Doritos Corn Chips  Cheese Supreme 170g     326
380g       Smiths Crnkle Chip  Orgnl Big Bag 380g      323
150g       Kettle Tortilla ChpsHny&Jlpno Chili 150g    323
165g       Tyrrells Crisps     Ched & Chives 165g      318
330g       Smiths Crinkle Chips Salt & Vinegar 330g    314
110g       Infuzions Thai SweetChili PotatoMix 110g    306
170g       Doritos Corn Chips  Original 170g           304
380g       Dorito Corn Chp     Supreme 380g            303
165g       Tyrrells Crisps     Lightly Salted 165g     301
110g       Cobs Popd Sour Crm  &Chives Chips 110g      299
170g       Doritos Corn Chips  Nacho Cheese 170g       296
110g       Cobs Popd Swt/Chlli &Sr/Cream Chips 110g    293
150g       Doritos Corn Chip Mexican Jalapeno 150g     290
           Kettle Tortilla ChpsFeta&Garlic 150g        288
175g       Thins Potato Chips  Hot & Spicy 175g        287
134g       Pringles Original   Crisps 134g             287
150g       Kettle Tortilla ChpsBtroot&Ricotta 150g     284
175g       Tostitos Smoked     Chipotle 175g           279
110g       Cobs Popd Sea Salt  Chips 110g              272
150g       Doritos Corn Chip Southern Chicken 150g     272
175g       Thins Chips Seasonedchicken 175g            271
           Thins Chips Light&  Tangy 175g              264
           Thins Chips Salt &  Vinegar 175g            256
           Thins Chips         Originl saltd 175g       88
           Natural ChipCo Sea  Salt & Vinegr 175g       85
           Natural Chip        Compny SeaSalt175g       82
           Smiths Chip Thinly  Cut Original 175g        80
           Natural Chip Co     Tmato Hrb&Spce 175g      79
           French Fries Potato Chips 175g               78
170g       Smiths Crinkle Cut  Chips Barbecue 170g      77
           Smiths Crinkle Cut  Chips Chs&Onion170g      76
```

```
           Smiths Crinkle Cut  Chips Original 170g      75
175g       Natural ChipCo      Hony Soy Chckn175g       75
90g        Snbts Whlgrn Crisps Cheddr&Mstrd 90g         71
175g       Smiths Chip Thinly  S/Cream&Onion 175g       71
200g       WW Supreme Cheese   Corn Chips 200g          65
160g       WW Original Stacked Chips 160g               64
           WW Sour Cream &OnionStacked Chips 160g       64
175g       Smiths Chip Thinly  CutSalt/Vinegr175g       63
170g       Smiths Crinkle Cut  Chips Chicken 170g       61
200g       WW Original Corn    Chips 200g               57
           WW D/Style Chip     Sea Salt 200g            57
90g        Sunbites Whlegrn    Crisps Frch/Onin 90g     57
Name: count, dtype: int64
```

#INSIGHTS: Young singles tend to buy larger packs of chips compared to the rest of the population

#RECOMMENDATIONS:

#From the above analysis, we can conclude a few things:
 # . The highest spending group comprises of retirees old families, couples and old singles while the lower
 #   percentage of store visitors are younger citizens.
 # . The largest customer premium group is the mainstream customer group, followed by the budget group then
 #   the premium customers.
 # . The driver of purchases here seems to be difference in age groups between the lifestage customer
 #   classifications. The younger families especially the new, young families and mid age family groups appear
 #   to be the least spenders probably because their budgets revolve mostly around family expenses (food etc.) as opposed
 #   to snacks. Older families and retirees may have less family expenses resulting to surplus that could be spent
 #   otherwise on snacks or casual purchases.

 # Therefore, my recommendation to the category manager is; since the highest spenders and older citizens, the
 # marketting department could come up with schemes to attract a bigger population of these spenders to
 # increase volume of sales.

 # The category manager could use the most popular chips data, 'Dorito Corn Chips' and suggest offers for this
 # brand. Maybe add raffle draws or an additional snack for every purchase or even price deductions to boost
 # volume sales.

```
# The category manager could recommend discounts on young family
customers that would encourage more spending
# for chips. Additionally, the stores could come up with kid packs for
different brands with toys or limited
# edition action figures to promote sales and attract customers from
this premium groups.
```