In [126]:
```
# import necessary modules
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
print('The modules has been loaded')
```

```
The modules has been loaded
```

In [2]:
```
# import the file
transaction_data_copy = pd.read_excel('QVI_transaction_data.xlsx')
transaction_data_copy.head()
```

Out[2]:

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

In [3]:
```
# Make a copy of the file
transaction_data = transaction_data_copy.copy()
transaction_data.head()
```

Out[3]:

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

In [4]:

```
# Check information of the dataframe
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  int64  
 1   STORE_NBR       264836 non-null  int64  
 2   LYLTY_CARD_NBR  264836 non-null  int64  
 3   TXN_ID          264836 non-null  int64  
 4   PROD_NBR        264836 non-null  int64  
 5   PROD_NAME       264836 non-null  object 
 6   PROD_QTY        264836 non-null  int64  
 7   TOT_SALES       264836 non-null  float64
dtypes: float64(1), int64(6), object(1)
memory usage: 16.2+ MB
```

In [5]:

```
# Date should be in a date format, not INT
# Store number should be in a string format, not INT
# https://stackoverflow.com/questions/48494376/pd-to-datetime-changes-the-value
transaction_data['DATE'] = pd.to_datetime(transaction_data['DATE'], errors='co
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  datetime64[ns]
 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: datetime64[ns](1), float64(1), int64(5), object(1)
memory usage: 16.2+ MB
```

In [6]:

```
# Change the store number into a string format
transaction_data['STORE_NBR'] = transaction_data['STORE_NBR'].astype(str)
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  datetime64[ns]
 1   STORE_NBR       264836 non-null  object
 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: datetime64[ns](1), float64(1), int64(4), object(2)
memory usage: 16.2+ MB
```

In [7]:

```
# check for possible outliers in the dates, get the min and max
print(f"Min: {transaction_data['DATE'].min()}, Max: {transaction_data['DATE'].
```

```
Min: 2018-07-01 00:00:00, Max: 2019-06-30 00:00:00
```

In [8]:

```
# Check the top 10 highest and lowest 10 products according to profitability
# Highest 10 profit and lowest 10
high_prof = transaction_data.sort_values('TOT_SALES', ascending=False)
high_prof
# Delete the 200 as the next ones are 5 and below.
# Lowest is 1, no negative numbers, values are ok.
```

Out[8]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_Q
69762	2018-08-19	226	226000	226201	4	Dorito Corn Chp Supreme 380g	2
69763	2019-05-20	226	226000	226210	4	Dorito Corn Chp Supreme 380g	2
69496	2018-08-15	49	49303	45789	14	Smiths Crnkle Chip Orgnl Big Bag 380g	
55558	2019-05-14	190	190113	190914	14	Smiths Crnkle Chip Orgnl Big Bag 380g	
171815	2018-08-17	24	24095	20797	14	Smiths Crnkle Chip Orgnl Big Bag 380g	
...	...	...	...	...	...	...	

In [9]:
```
transaction_data.loc[transaction_data['STORE_NBR'] == '226'].sort_values(['PRO
# 200 is an outlier. Value is based on two time transactions only.
```

Out[9]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_
169	2019-05-15	226	226133	226926	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	
172209	2018-08-18	226	226346	228074	109	Pringles Barbeque 134g	
172210	2018-08-17	226	226357	228136	49	Infuzions SourCream&Herbs Veg Strws 110g	
117932	2018-08-18	226	226014	226283	51	Doritos Mexicana 170g	
117934	2018-08-16	226	226127	226887	60	Kettle Tortilla ChpsFeta&Garlic 150g	
...	...	...	...	...	...	...	
217278	2018-08-19	226	226378	228250	81	Pringles Original Crisps 134g	
117935	2019-05-14	226	226193	227260	40	Thins Chips Seasonedchicken 175g	
32759	2018-08-16	226	226251	227562	15	Twisties Cheese 270g	
69763	2019-05-20	226	226000	226210	4	Dorito Corn Chp Supreme 380g	
69762	2018-08-19	226	226000	226201	4	Dorito Corn Chp Supreme 380g	

2022 rows × 8 columns

In [10]:

```
transaction_data = transaction_data.drop(transaction_data[transaction_data["PR
transaction_data.sort_values('TOT_SALES', ascending=False)
```

Out[10]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_Q
55558	2019-05-14	190	190113	190914	14	Smiths Crnkle Chip Orgnl Big Bag 380g	
5179	2018-08-15	94	94148	93390	14	Smiths Crnkle Chip Orgnl Big Bag 380g	
117850	2019-05-19	194	194308	194516	14	Smiths Crnkle Chip Orgnl Big Bag 380g	
150683	2019-05-20	118	118021	120799	14	Smiths Crnkle Chip Orgnl Big Bag 380g	
184969	2019-05-20	44	44350	40394	14	Smiths Crnkle Chip Orgnl Big Bag 380g	
...	...	...	...	...	...	...	

In [11]:

```
transaction_data.describe()
```

Out[11]:

	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_QTY	TOT_SALES
count	2.648340e+05	2.648340e+05	264834.000000	264834.000000	264834.000000
mean	1.355488e+05	1.351576e+05	56.583554	1.905813	7.299346
std	8.057990e+04	7.813292e+04	32.826444	0.343436	2.527241
min	1.000000e+03	1.000000e+00	1.000000	1.000000	1.500000
25%	7.002100e+04	6.760050e+04	28.000000	2.000000	5.400000
50%	1.303570e+05	1.351365e+05	56.000000	2.000000	7.400000
75%	2.030940e+05	2.026998e+05	85.000000	2.000000	9.200000
max	2.373711e+06	2.415841e+06	114.000000	5.000000	29.500000

In [12]:

```
transaction_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 264834 entries, 0 to 264835
Data columns (total 8 columns):
 #   Column          Non-Null Count   Dtype         
---  ------          --------------   -----         
 0   DATE            264834 non-null  datetime64[ns]
 1   STORE_NBR       264834 non-null  object        
 2   LYLTY_CARD_NBR  264834 non-null  int64         
 3   TXN_ID          264834 non-null  int64         
 4   PROD_NBR        264834 non-null  int64         
 5   PROD_NAME       264834 non-null  object        
 6   PROD_QTY        264834 non-null  int64         
 7   TOT_SALES       264834 non-null  float64       
dtypes: datetime64[ns](1), float64(1), int64(4), object(2)
memory usage: 18.2+ MB
```

In [13]:

```
# Check transaction data by date
# Why only 364 rows?
transaction_data.groupby(['DATE'])[["PROD_QTY", "TOT_SALES"]].sum()
```

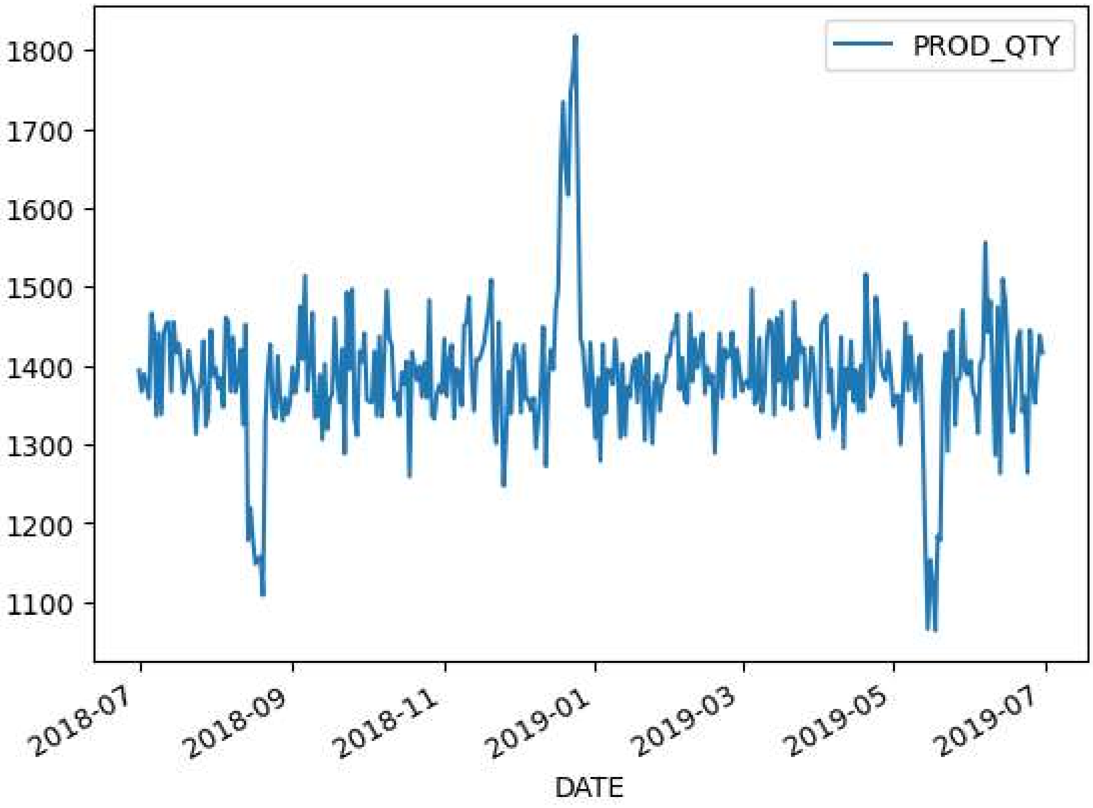
Out[13]:

	PROD_QTY	TOT_SALES
DATE		
2018-07-01	1394	5372.2
2018-07-02	1367	5315.4
2018-07-03	1389	5321.8
2018-07-04	1373	5309.9
2018-07-05	1358	5080.9
...	...	...
2019-06-26	1380	5305.0
2019-06-27	1352	5202.8
2019-06-28	1400	5299.6
2019-06-29	1438	5497.6
2019-06-30	1416	5423.4

364 rows × 2 columns

In [14]:
```
transaction_data.groupby(['DATE'])[["PROD_QTY"]].sum().plot()
```

Out[14]:
```
<Axes: xlabel='DATE'>
```



In [15]:
```
# Find the missing day
# https://www.tutorialspoint.com/python-how-to-check-missing-dates-in-pandas
date_index = transaction_data.set_index('DATE')
k = pd.date_range(start='2018-07-01', end='2019-06-30').difference(date_index.
print('There are no transactions on: ', k)
# Christmas day
```

```
There are no transactions on:  DatetimeIndex(['2018-12-25'], dtype='datetime6
4[ns]', freq=None)
```

In [16]:

```
# Delete all unrelated products (salsa)
transaction_data[~transaction_data["PROD_NAME"].str.contains("Salsa | salsa")
# from 264,834 to 246,740
```

Out[16]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QT
0	2018-10-17	1	1000	1	5	Natural Chip Compny SeaSalt175g	
1	2019-05-14	1	1307	348	66	CCs Nacho Cheese 175g	
2	2019-05-20	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	
3	2018-08-17	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion 175g	
4	2018-08-18	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	
...	...	...	...	...	...	...	.
264831	2019-03-09	272	272319	270088	89	Kettle Sweet Chilli And Sour Cream 175g	
264832	2018-08-13	272	272358	270154	74	Tostitos Splash Of Lime 175g	
264833	2018-11-06	272	272379	270187	51	Doritos Mexicana 170g	
264834	2018-12-27	272	272379	270188	42	Doritos Corn Chip Mexican Jalapeno 150g	
264835	2018-09-22	272	272380	270189	74	Tostitos Splash Of Lime 175g	

246740 rows × 8 columns

In [17]:
```
transaction_data
```

Out[17]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_(
0	2018-10-17	1	1000	1	5	Natural Chip Compny SeaSalt175g	
1	2019-05-14	1	1307	348	66	CCs Nacho Cheese 175g	
2	2019-05-20	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	
3	2018-08-17	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion 175g	
4	2018-08-18	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	
...	...	...	...	...	...	...	

PRODUCT SIZES

In [18]:
```
# Extract product sizes
transaction_data['PROD_SIZE'] = transaction_data['PROD_NAME'].str.extract('(\d
transaction_data['PROD_SIZE']
```

Out[18]:
```
0         175g
1         175g
2         170g
3         175g
4         150g
          ...
264831    175g
264832    175g
264833    170g
264834    150g
264835    175g
Name: PROD_SIZE, Length: 264834, dtype: object
```

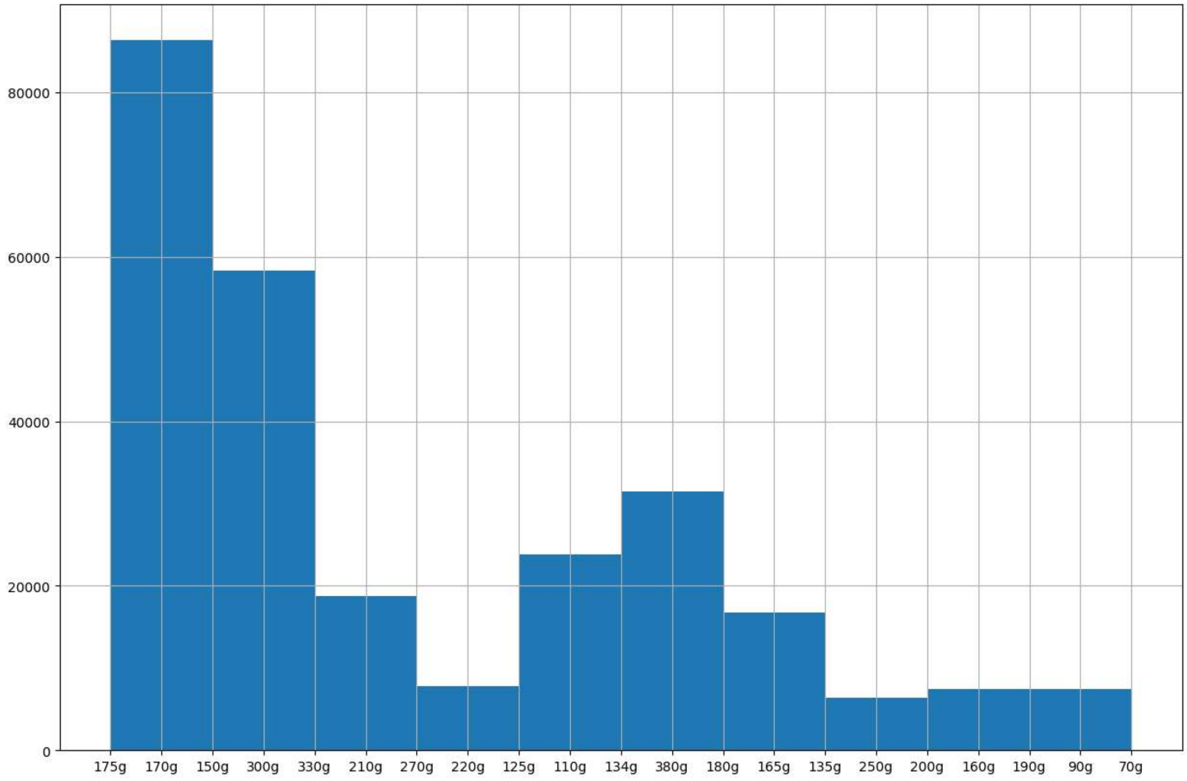
In [19]:
```
transaction_data.groupby(['PROD_SIZE'])[["PROD_QTY"]].sum()
```

Out[19]:

PROD_SIZE	PROD_QTY
110g	42835
125g	2730
134g	48019
135g	6212
150g	82174
160g	5604
165g	29051
170g	38088
175g	126467
180g	2764
190g	5673

In [20]:
```
# Create histogram of the pack sizes
transaction_data['PROD_SIZE'].hist(figsize=(15, 10))
```

Out[20]:
```
<Axes: >
```



BRANDS

In [21]:
```
transaction_data['PROD_NAME']
```

Out[21]:
```
0           Natural Chip        Compny SeaSalt175g
1                         CCs Nacho Cheese    175g
2           Smiths Crinkle Cut  Chips Chicken 170g
3           Smiths Chip Thinly  S/Cream&Onion 175g
4         Kettle Tortilla ChpsHny&Jlpno Chili 150g
                            ...
264831     Kettle Sweet Chilli And Sour Cream 175g
264832               Tostitos Splash Of  Lime 175g
264833                    Doritos Mexicana    170g
264834     Doritos Corn Chip Mexican Jalapeno 150g
264835               Tostitos Splash Of  Lime 175g
Name: PROD_NAME, Length: 264834, dtype: object
```

In [22]:
```
transaction_data['BRAND_NAME'] = transaction_data['PROD_NAME'].str.split(' ').
transaction_data
```

Out[22]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_
0	2018-10-17	1	1000	1	5	Natural Chip Compny SeaSalt175g	
1	2019-05-14	1	1307	348	66	CCs Nacho Cheese 175g	
2	2019-05-20	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	
3	2018-08-17	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion 175g	
4	2018-08-18	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	
...	...	...	...	...	...	...	

In [23]:
```
transaction_data.groupby(['BRAND_NAME'])[["PROD_QTY"]].sum()
```

Out[23]:
```
              PROD_QTY
BRAND_NAME
    BURGER        2970
       CCS        8609
   CHEETOS        5530
  CHEEZELS        8747
      COBS       18571
    DORITO        6109
   DORITOS       47707
    FRENCH        2643
     GRAIN       11962
   GRNWVES        2764
 INFUZIONS       21119
    INFZNS        6000
    KETTLE       79051
   NATURAL       11424
       NCC        2682
       OLD       17805
  PRINGLES       48019
       RED       11146
       RRD       22500
     SMITH        5609
    SMITHS       54730
     SNBTS        2986
  SUNBITES        2706
     THINS       26929
  TOSTITOS       18134
  TWISTIES       18118
  TYRRELLS       12298
WOOLWORTHS        8395
        WW       19461
```

In [24]:

```python
# Correct some of the brand names
# RED = RRD
# SNBTS = SUNBITES
# INFZNS = INFUZIONS
# WW = WOOLWORTHS
# SMITH = SMITHS
# NCC = NATURAL
# DORITO = DORITOS
# GRAIN = GRNWVES
transaction_data['BRAND_NAME'].replace('RED', 'RRD', inplace=True)
transaction_data['BRAND_NAME'].replace('SNBTS', 'SUNBITES', inplace=True)
transaction_data['BRAND_NAME'].replace('INFZNS', 'INFUZIONS', inplace=True)
transaction_data['BRAND_NAME'].replace('WW', 'WOOLWORTHS', inplace=True)
transaction_data['BRAND_NAME'].replace('SMITH', 'SMITHS', inplace=True)
transaction_data['BRAND_NAME'].replace('NCC', 'NATURAL', inplace=True)
transaction_data['BRAND_NAME'].replace('DORITO', 'DORITOS', inplace=True)
transaction_data['BRAND_NAME'].replace('GRAIN', 'GRNWVES', inplace=True)
transaction_data.groupby(['BRAND_NAME'])[["PROD_QTY"]].sum()
```

Out[24]:

	PROD_QTY
BRAND_NAME	
BURGER	2970
CCS	8609
CHEETOS	5530
CHEEZELS	8747
COBS	18571
DORITOS	53816
FRENCH	2643
GRNWVES	14726
INFUZIONS	27119
KETTLE	79051
NATURAL	14106

DATA CLEANING & SOME ANALYTICS ON transaction_behaviors are done, proceeding to customer data.

In [25]:

```
purchase_behavior_copy = pd.read_csv('QVI_purchase_behaviour.csv')
purchase_behavior = purchase_behavior_copy.copy()
purchase_behavior
```

Out[25]:

	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 × 3 columns

In [26]:

```
purchase_behavior.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 72637 entries, 0 to 72636
Data columns (total 3 columns):
 #   Column            Non-Null Count  Dtype 
---  ------            --------------  ----- 
 0   LYLTY_CARD_NBR    72637 non-null  int64 
 1   LIFESTAGE         72637 non-null  object
 2   PREMIUM_CUSTOMER  72637 non-null  object
dtypes: int64(1), object(2)
memory usage: 1.7+ MB
```

In [27]:

```
# Check count of members per lifestage
purchase_behavior.groupby(['LIFESTAGE'])[["LYLTY_CARD_NBR"]].count()
```

Out[27]:

	LYLTY_CARD_NBR
LIFESTAGE	
MIDAGE SINGLES/COUPLES	7275
NEW FAMILIES	2549
OLDER FAMILIES	9780
OLDER SINGLES/COUPLES	14609
RETIREES	14805
YOUNG FAMILIES	9178
YOUNG SINGLES/COUPLES	14441

In [119]:
```
# check number of members per service type
service_type = purchase_behavior.groupby(['PREMIUM_CUSTOMER'])[["LYLTY_CARD_NB
service_type
```

Out[119]:

	LYLTY_CARD_NBR
PREMIUM_CUSTOMER	
Budget	24470
Mainstream	29245
Premium	18922

In [29]:
```
# left join the two tables through loyalty card number
customer_data = transaction_data.merge(purchase_behavior, on='LYLTY_CARD_NBR',
customer_data
```

Out[29]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_
0	2018-10-17	1	1000	1	5	Natural Chip Compny SeaSalt175g	
1	2019-05-14	1	1307	348	66	CCs Nacho Cheese 175g	
2	2019-05-20	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	
3	2018-08-17	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion 175g	
4	2018-08-18	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili 150g	
...	...	...	...	...	...	...	

In [30]:
```
# Check for null in case some has not been joined
# https://stackoverflow.com/questions/27159189/find-empty-or-nan-entry-in-pand
np.where(pd.isnull(customer_data))
```

Out[30]:
```
(array([], dtype=int64), array([], dtype=int64))
```

In [31]:
```
# Check for empty strings
np.where(customer_data.applymap(lambda x: x == ''))
```

Out[31]:
```
(array([], dtype=int64), array([], dtype=int64))
```

In [32]:

```
# Export new data frame as an excel
customer_data.to_excel('customer_transaction_behavior.xlsx')
print('File has been transported to excel')
```

```
File has been transported to excel
```

DATA ANALYSIS ON CUSTOMER SEGMENTS

Metrics:

- Product Quantity and Total Sales by Service Type and Lifestage
-

Analysis on lifestages

In [113]:

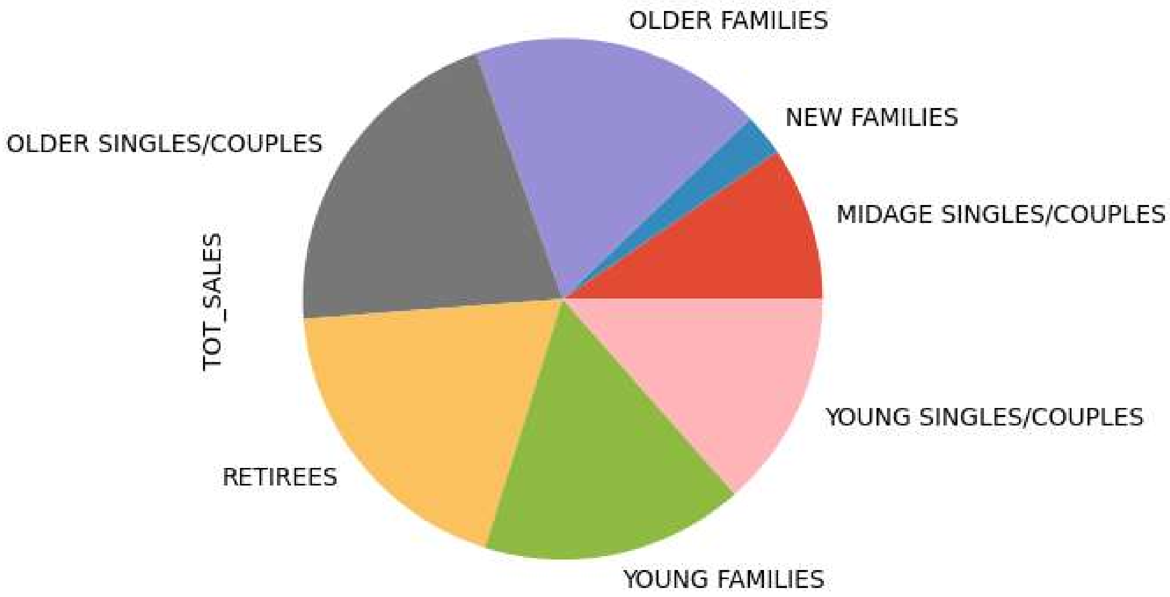
```
# Lifestages spending habits
lifestage_spent = customer_data.groupby(['LIFESTAGE'])[['TOT_SALES']].sum().so
lifestage_spent
```

Out[113]:

	TOT_SALES
LIFESTAGE	
OLDER SINGLES/COUPLES	402,427
RETIREES	366,471
OLDER FAMILIES	352,467
YOUNG FAMILIES	316,160
YOUNG SINGLES/COUPLES	260,405
MIDAGE SINGLES/COUPLES	184,751
NEW FAMILIES	50,433

In [146]:
```
lifestage_pie = customer_data.groupby(['LIFESTAGE']).sum().plot(kind='pie', y=
plt.savefig('lifestage_pie.jpg')
```

```
C:\Program Files\Sublime Text\sublime_text.exe\ipykernel_6556\3219922933.py:
1: FutureWarning: The default value of numeric_only in DataFrameGroupBy.sum i
s deprecated. In a future version, numeric_only will default to False. Either
specify numeric_only or select only columns which should be valid for the fun
ction.
  lifestage_pie = customer_data.groupby(['LIFESTAGE']).sum().plot(kind='pie',
y="TOT_SALES", legend=False)
```



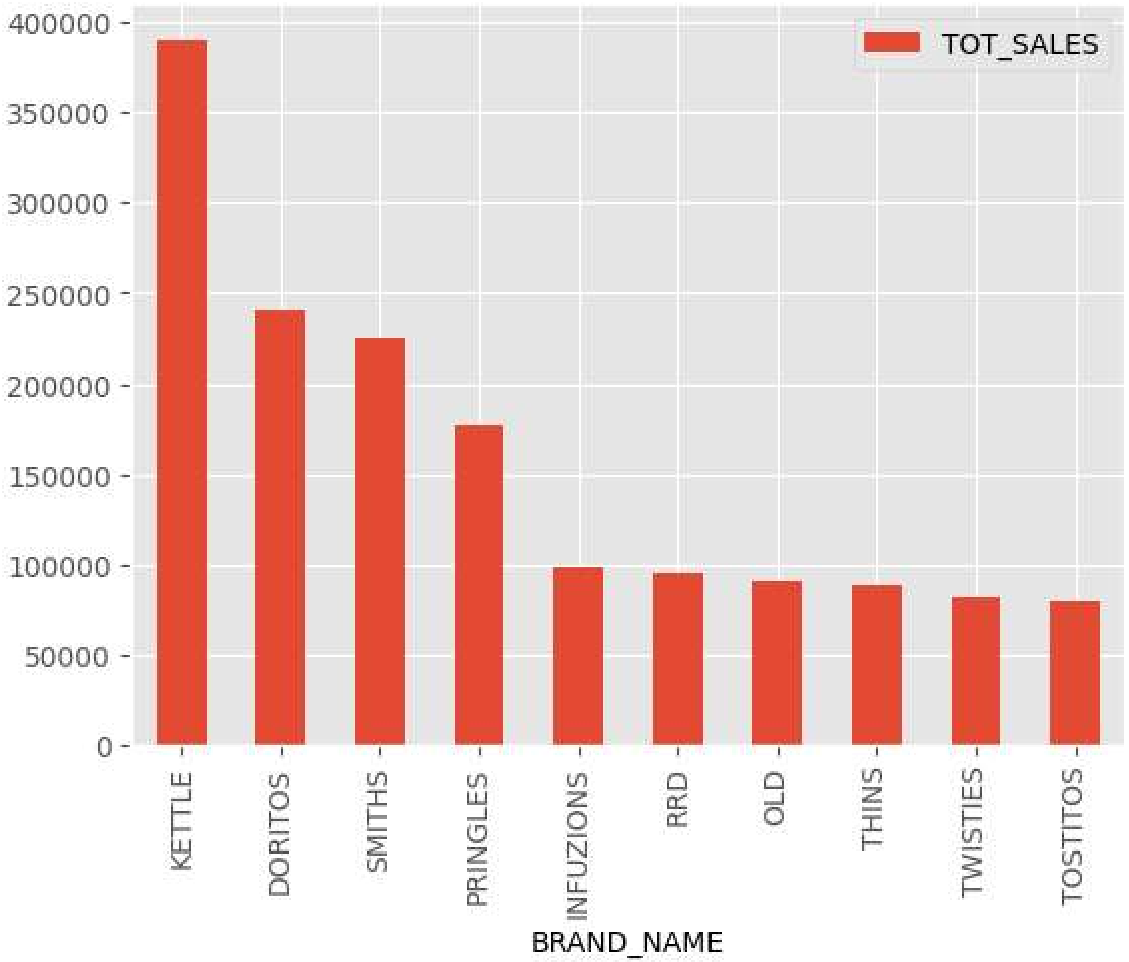
In [150]:

```
# brand
brand = customer_data.groupby(['BRAND_NAME'])[['TOT_SALES']].sum().sort_values
brand
```

Out[150]:

	TOT_SALES
BRAND_NAME	
KETTLE	390,240
DORITOS	240,591
SMITHS	224,660
PRINGLES	177,656
INFUZIONS	99,048
RRD	95,046
OLD	90,785
THINS	88,852
TWISTIES	81,522
TOSTITOS	79,790
COBS	70.570

In [175]:
```
customer_data.groupby(['BRAND_NAME'])[['TOT_SALES']].sum().sort_values(by="TOT_
plt.savefig('best_selling_brands.jpg')
```



In [117]:

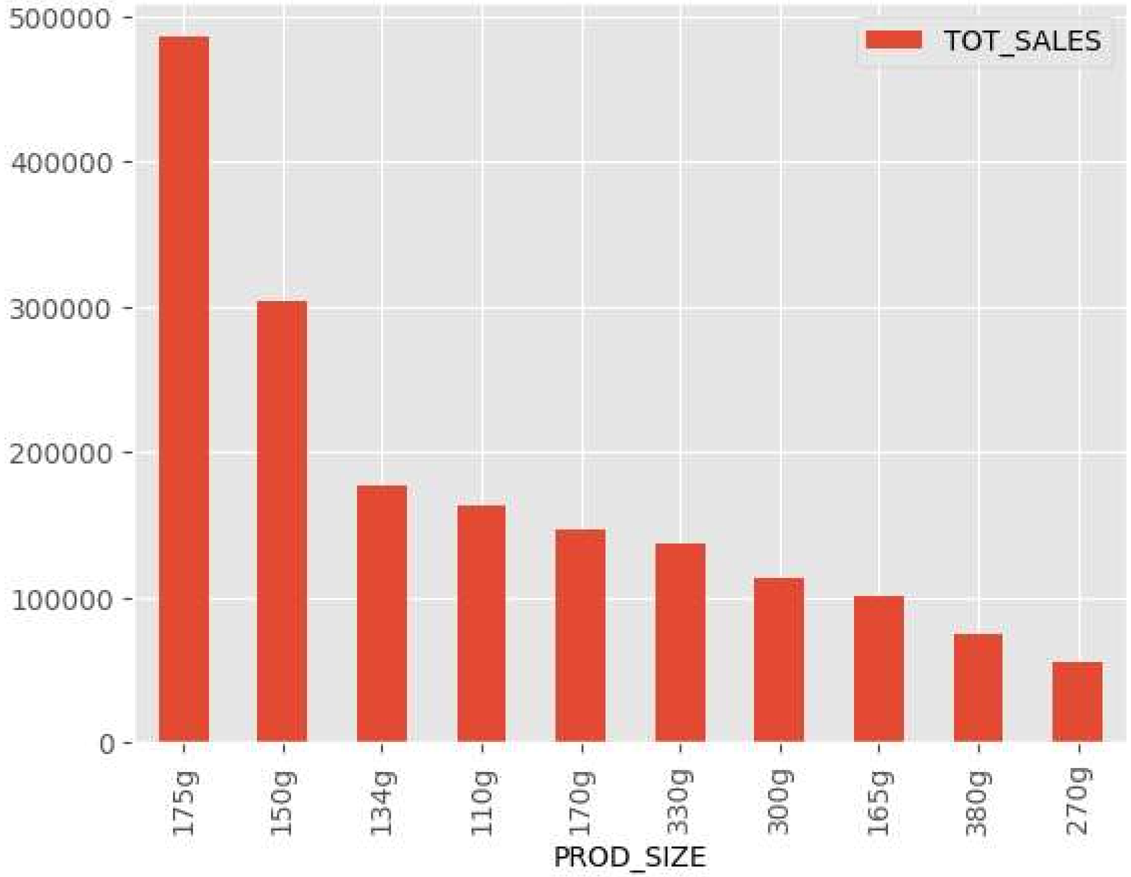
```
# Product Size
# brand
prod_size = customer_data.groupby(['PROD_SIZE'])[['TOT_SALES']].sum().sort_valu
prod_size
```

Out[117]:

```
            TOT_SALES
PROD_SIZE
     175g     485,437
     150g     304,288
     134g     177,656
     110g     162,765
     170g     146,673
     330g     136,794
     300g     113,331
     165g     101,361
     380g      75,420
     270g      55,425
     210g      43,049
```

In [176]:

```
customer_data.groupby(['PROD_SIZE'])[['TOT_SALES']].sum().sort_values(by="TOT_
plt.savefig('pack_size.jpg')
```



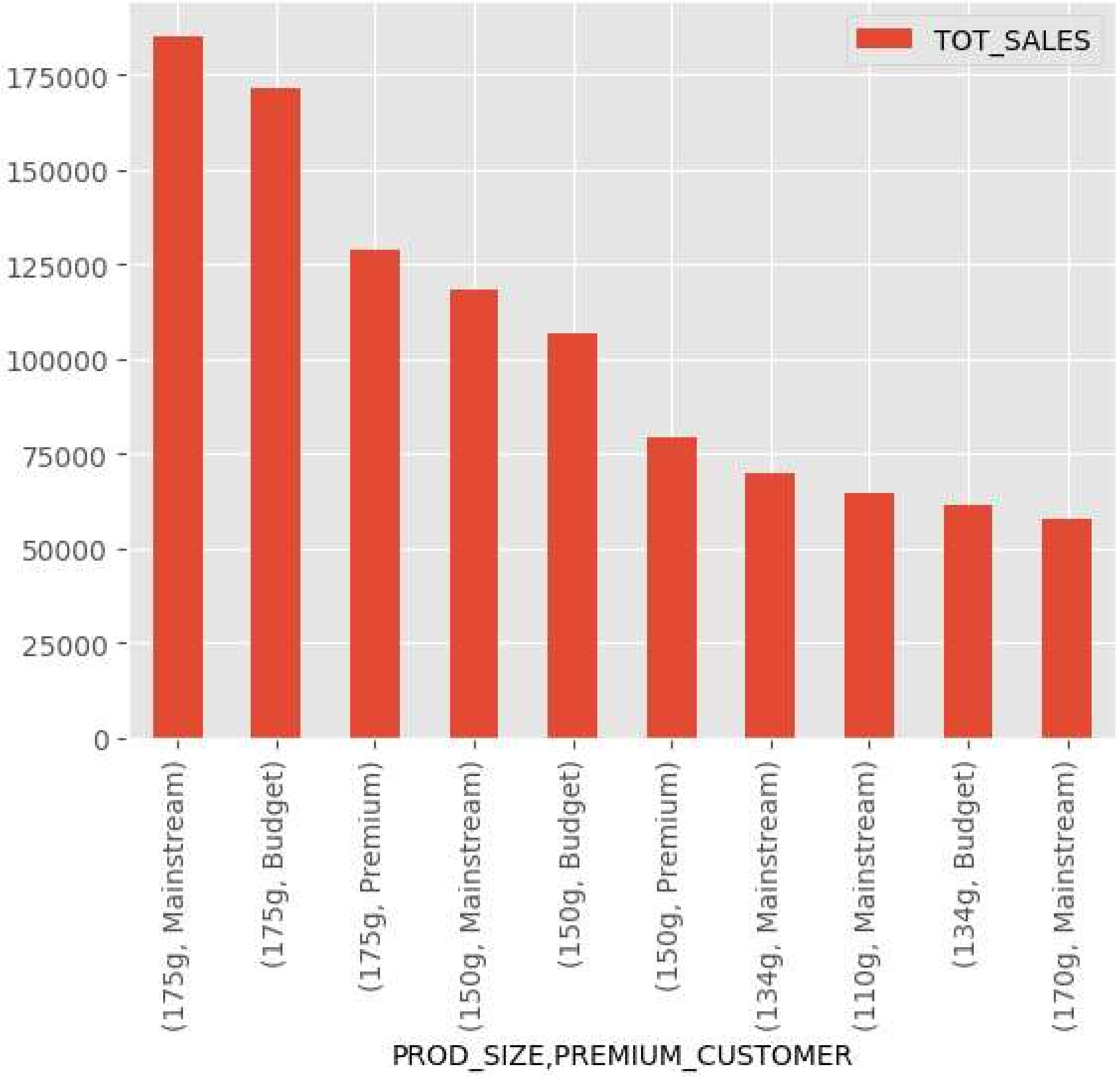
In [114]:

```
# Segregation of data on LIFESTAGE and PREMIUM_CUSTOMER
lifestage_premium_customer = customer_data.groupby(['LIFESTAGE', 'PREMIUM_CUST
lifestage_premium_customer
```

Out[114]:

		PROD_QTY	TOT_SALES
LIFESTAGE	PREMIUM_CUSTOMER		
OLDER FAMILIES	Budget	45,065	168,363
YOUNG SINGLES/COUPLES	Mainstream	38,632	157,622
RETIREES	Mainstream	40,518	155,677
YOUNG FAMILIES	Budget	37,111	139,346
	Budget	35,220	136,770
OLDER SINGLES/COUPLES	Mainstream	34,997	133,394
	Premium	33,986	132,263
RETIREES	Budget	28,764	113,148
OLDER FAMILIES	Mainstream	27,756	103,446
RETIREES	Premium	24,884	97,646
YOUNG FAMILIES	Mainstream	25,044	92,789

In [177]:
```
customer_data.groupby(['PROD_SIZE', 'PREMIUM_CUSTOMER'])[['TOT_SALES']].sum().
plt.savefig('prod_and_size.jpg')
```



In [111]:

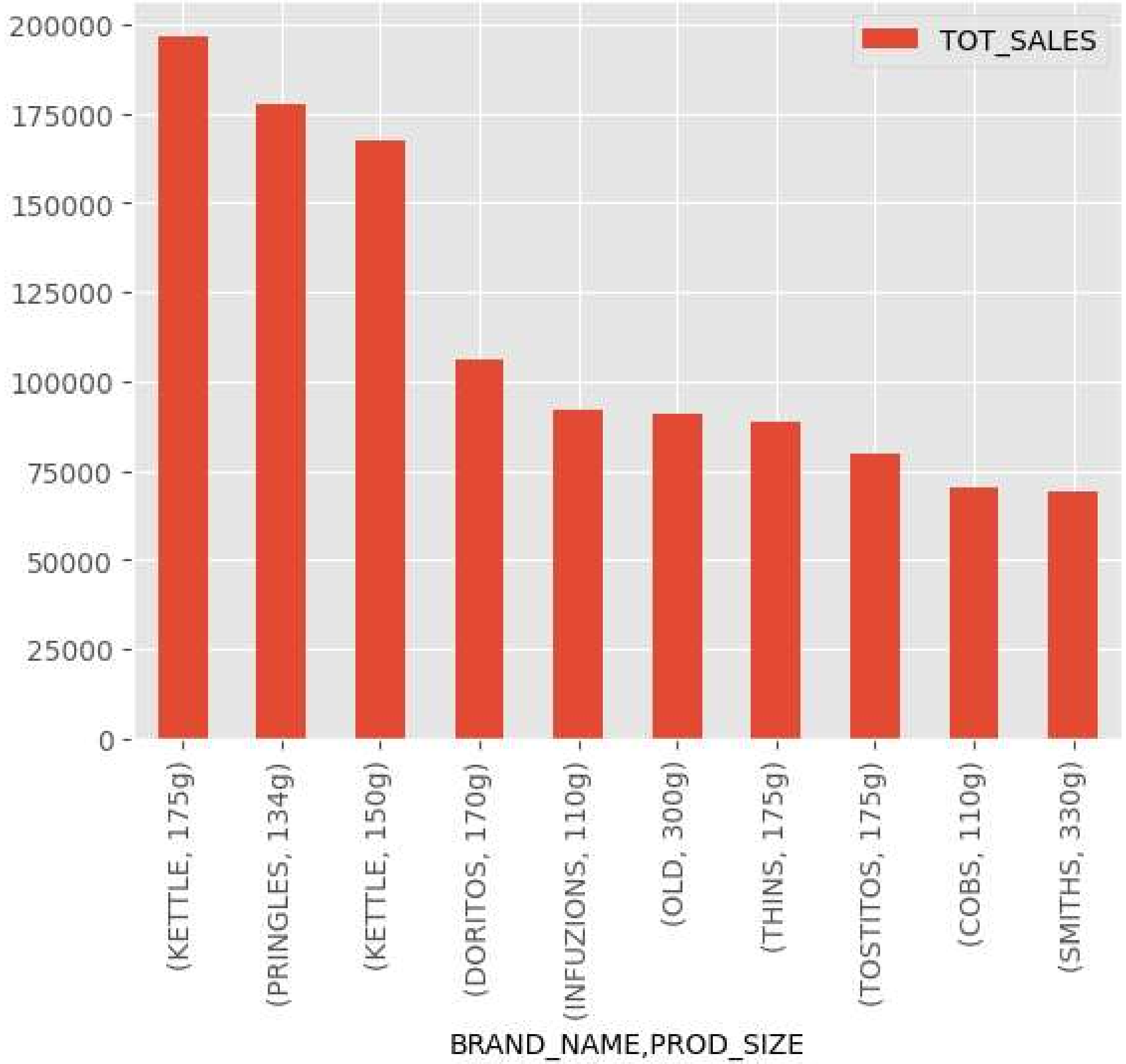
```python
# Per brand
per_brand = customer_data.groupby(['BRAND_NAME', 'PROD_SIZE'])[['PROD_QTY', 'T
per_brand
```

Out[111]:

```
                        PROD_QTY  TOT_SALES
BRAND_NAME  PROD_SIZE
     KETTLE      175g     36,425    196,668
   PRINGLES      134g     48,019    177,656
     KETTLE      150g     36,414    167,481
    DORITOS      170g     24,153    106,264
  INFUZIONS      110g     24,264     92,196
        OLD      300g     17,805     90,785
      THINS      175g     26,929     88,852
   TOSTITOS      175g     18,134     79,790
       COBS      110g     18,571     70,570
     SMITHS      330g     12,124     69,107
   TWISTIES      270g     12,049     55,425
```

In [178]:

```
customer_data.groupby(['BRAND_NAME', 'PROD_SIZE'])[['TOT_SALES']].sum().sort_v
plt.savefig('brand_size.jpg')
```



In [174]:

```
brand_lifestage = customer_data.groupby(['LIFESTAGE', 'BRAND_NAME', 'PROD_SIZE
brand_lifestage
```

Out[174]:

			PROD_QTY	TOT_SALES
LIFESTAGE	**BRAND_NAME**	**PROD_SIZE**		
OLDER SINGLES/COUPLES	**KETTLE**	**175g**	7,692	41,521
RETIREES	**KETTLE**	**175g**	7,221	38,993
OLDER SINGLES/COUPLES	**PRINGLES**	**134g**	10,163	37,603
	KETTLE	**150g**	7,915	36,391
RETIREES	**PRINGLES**	**134g**	9,432	34,898
OLDER FAMILIES	**KETTLE**	**175g**	6,145	33,178
RETIREES	**KETTLE**	**150g**	7,160	32,936
OLDER FAMILIES	**PRINGLES**	**134g**	8,266	30,584
YOUNG FAMILIES	**KETTLE**	**175g**	5,644	30,478
OLDER FAMILIES	**KETTLE**	**150g**	6,185	28,451
YOUNG FAMILIES	**PRINGLES**	**134g**	7,435	27,498

Conclusions

The age group that brings in the most income are those who are in the group of older singles/couples followed by the retirees.

The top five most profitable brands are kettle, doritos, smiths, pringles, and infuzions. The top five most profitable product sizes are 175g, 150g, 134g, 110g, and 170g.

Kettle seems to be the most popular product, especially the 175g pack that is most popular among the older singles/couples and retirees. Kettle is followed by pringles, and Doritos. It is best to maintain stocks of these products on all stores.

We should also gauge products that are on the least bought by customers, most especially the cheetos, sunbites, french, and burger. We should always check if stocks are being bought on time before their expirations dates and/or if the amount of time that they have been sitting in the store is disadvantageous. It is best to observe and just put the right amount of stock for the product.