We need to present a strategic recommendation to Julia that is supported by data which she can then use for the upcoming category review however to do so we need to analyse the data to understand the current purchasing trends and behaviours. The client is particularly interested in customer segments and their chip purchasing behaviour. Consider what metrics would help describe the customers' purchasing behaviour.

```
import numpy as np
import pandas as pd
pd.plotting.register_matplotlib_converters()
import matplotlib.pyplot as plt
%matplotlib inline
import plotly.express as px
from plotly.subplots import make_subplots
import plotly.graph_objects as go
from scipy.stats import ttest_ind
from mlxtend.frequent_patterns import apriori
from mlxtend.frequent_patterns import association_rules
import re
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

```
# Read data
transaction=pd.read_excel('QVI_transaction_data.xlsx')
customer=pd.read_csv('QVI_purchase_behaviour.csv')
```

```
# Print first 10 rows
transaction.head()
```

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

```
customer.head()
```

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

Lets merge the transaction and purchase behavior ("customers") datasets on loyalty card number "LYLTY_CARD_NUMBER" using a right join for further exploration

```
df = pd.merge(customer, transaction, on="LYLTY_CARD_NBR", how="right")
df.head()
```

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

```
#checking the total number of columns and rows
df.shape
```

```
(264836, 10)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 264836 entries, 0 to 264835
Data columns (total 10 columns):
 #   Column            Non-Null Count   Dtype  
---  ------            --------------   -----  
 0   LYLTY_CARD_NBR    264836 non-null  int64  
 1   LIFESTAGE         264836 non-null  object 
 2   PREMIUM_CUSTOMER  264836 non-null  object 
 3   DATE              264836 non-null  int64  
 4   STORE_NBR         264836 non-null  int64  
 5   TXN_ID            264836 non-null  int64  
 6   PROD_NBR          264836 non-null  int64  
 7   PROD_NAME         264836 non-null  object 
 8   PROD_QTY          264836 non-null  int64  
 9   TOT_SALES         264836 non-null  float64
dtypes: float64(1), int64(6), object(3)
memory usage: 22.2+ MB
```

```
# correcting DATE datatype from int to date
df["DATE"] = pd.to_datetime(df["DATE"], origin="1899-12-30",unit="D")
df['DATE'].head()
```

```
0   2018-10-17
1   2019-05-14
2   2019-05-20
3   2018-08-17
4   2018-08-18
Name: DATE, dtype: datetime64[ns]
```

```
df["PROD_NAME"].unique()
```

```
array(['Natural Chip        Compny SeaSalt175g',
       'CCs Nacho Cheese    175g',
       'Smiths Crinkle Cut  Chips Chicken 170g',
       'Smiths Chip Thinly  S/Cream&Onion 175g',
       'Kettle Tortilla ChpsHny&Jlpno Chili 150g',
       'Old El Paso Salsa   Dip Tomato Mild 300g',
       'Smiths Crinkle Chips Salt & Vinegar 330g',
       'Grain Waves         Sweet Chilli 210g',
       'Doritos Corn Chip Mexican Jalapeno 150g',
       'Grain Waves Sour    Cream&Chives 210G',
       'Kettle Sensations   Siracha Lime 150g',
       'Twisties Cheese     270g', 'WW Crinkle Cut      Chicken 175g',
       'Thins Chips Light&  Tangy 175g', 'CCs Original 175g',
       'Burger Rings 220g', 'NCC Sour Cream &    Garden Chives 175g',
       'Doritos Corn Chip Southern Chicken 150g',
       'Cheezels Cheese Box 125g', 'Smiths Crinkle      Original 330g',
       'Infzns Crn Crnchers Tangy Gcamole 110g',
       'Kettle Sea Salt     And Vinegar 175g',
       'Smiths Chip Thinly  Cut Original 175g', 'Kettle Original 175g',
       'Red Rock Deli Thai  Chilli&Lime 150g',
       'Pringles Sthrn FriedChicken 134g', 'Pringles Sweet&Spcy BBQ 134g',
       'Red Rock Deli SR    Salsa & Mzzrlla 150g',
       'Thins Chips         Originl saltd 175g',
       'Red Rock Deli Sp    Salt & Truffle 150G',
       'Smiths Thinly       Swt Chli&S/Cream175G', 'Kettle Chilli 175g',
       'Doritos Mexicana    170g',
       'Smiths Crinkle Cut  French OnionDip 150g',
       'Natural ChipCo      Hony Soy Chckn175g',
       'Dorito Corn Chp     Supreme 380g', 'Twisties Chicken270g',
       'Smiths Thinly Cut   Roast Chicken 175g',
       'Smiths Crinkle Cut  Tomato Salsa 150g',
       'Kettle Mozzarella   Basil & Pesto 175g',
       'Infuzions Thai SweetChili PotatoMix 110g',
       'Kettle Sensations   Camembert & Fig 150g',
       'Smith Crinkle Cut   Mac N Cheese 150g',
       'Kettle Honey Soy    Chicken 175g',
       'Thins Chips Seasonedchicken 175g',
       'Smiths Crinkle Cut  Salt & Vinegar 170g',
       'Infuzions BBQ Rib   Prawn Crackers 110g',
       'GrnWves Plus Btroot & Chilli Jam 180g',
       'Tyrrells Crisps     Lightly Salted 165g',
       'Kettle Sweet Chilli And Sour Cream 175g',
       'Doritos Salsa       Medium 300g', 'Kettle 135g Swt Pot Sea Salt',
       'Pringles SourCream  Onion 134g',
       'Doritos Corn Chips  Original 170g',
       'Twisties Cheese     Burger 250g',
       'Old El Paso Salsa   Dip Chnky Tom Ht300g',
       'Cobs Popd Swt/Chlli &Sr/Cream Chips 110g',
       'Woolworths Mild     Salsa 300g',
       'Natural Chip Co     Tmato Hrb&Spce 175g',
       'Smiths Crinkle Cut  Chips Original 170g',
       'Cobs Popd Sea Salt  Chips 110g',
       'Smiths Crinkle Cut  Chips Chs&Onion170g',
       'French Fries Potato Chips 175g',
       'Old El Paso Salsa   Dip Tomato Med 300g',
       'Doritos Corn Chips  Cheese Supreme 170g',
       'Pringles Original   Crisps 134g',
       'RRD Chilli&         Coconut 150g',
```

```
# Extracting pack size from the Product
import re
def find_number(text):
    num = re.findall(r'[0-9]+',text)
    return " ".join(num)
df['pack_size']=df['PROD_NAME'].apply(lambda x: find_number(x))
df
```

	LYLTY_CARD_NBR	LIFESTAGE	PREMIUM_CUSTOMER	DATE	STORE_NBR	TXN_ID	PROD_NBR	PRO
0	1000	YOUNG SINGLES/COUPLES	Premium	2018-10-17	1	1	5	Natural Chip Compny Sea
1	1307	MIDAGE SINGLES/COUPLES	Budget	2019-05-14	1	348	66	CCs Nacho Chee
2	1343	MIDAGE SINGLES/COUPLES	Budget	2019-05-20	1	383	61	Smiths Crinkle Cut Chips Chick
3	2373	MIDAGE SINGLES/COUPLES	Budget	2018-08-17	2	974	69	Smiths Chip Thinly S/Cream&Oni
4	2426	MIDAGE SINGLES/COUPLES	Budget	2018-08-18	2	1038	108	Kettle Tortilla ChpsHny&Jlpno C
...	...	...	...	...	...	...	...	
264831	272319	YOUNG SINGLES/COUPLES	Premium	2019-03-09	272	270088	89	Kettle Sweet Chilli And Sour Crea
264832	272358	YOUNG SINGLES/COUPLES	Premium	2018-08-13	272	270154	74	Tostitos Splash Of Lir
264833	272379	YOUNG SINGLES/COUPLES	Premium	2018-11-06	272	270187	51	Doritos Mexica
264834	272379	YOUNG SINGLES/COUPLES	Premium	2018-12-27	272	270188	42	Doritos Corn Chip Mexican Jalape
264835	272380	YOUNG SINGLES/COUPLES	Premium	2018-09-22	272	270189	74	Tostitos Splash Of Lir

264836 rows × 11 columns

```
# Split product names as well as remove all digits and special characters such as '&'
import re
 prn= df["PROD_NAME"].str.replace('([0-9]+[gG])','').str.replace('[^\w]', ' ').str.split()

# Calculate the frequency grouped by words and sort them
prf = pd.value_counts([word for name in prn
                                  for word in name]).sort_values(ascending=False)
prf.head()
```

```
Chips     49770
Kettle    41288
Smiths    28860
Salt      27976
Cheese    27890
dtype: int64
```

```
# Remove salsa from the list of products n other to concentrate only on chips which is our core focus in this analysis
df = df[~df["PROD_NAME"].str.contains("[Ss]alsa")]
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 246742 entries, 0 to 264835
Data columns (total 11 columns):
 #   Column            Non-Null Count   Dtype         
---  ------            --------------   -----         
 0   LYLTY_CARD_NBR    246742 non-null  int64         
 1   LIFESTAGE         246742 non-null  object        
 2   PREMIUM_CUSTOMER  246742 non-null  object        
 3   DATE              246742 non-null  datetime64[ns]
 4   STORE_NBR         246742 non-null  int64         
 5   TXN_ID            246742 non-null  int64         
 6   PROD_NBR          246742 non-null  int64         
 7   PROD_NAME         246742 non-null  object        
 8   PROD_QTY          246742 non-null  int64         
 9   TOT_SALES         246742 non-null  float64       
 10  pack_size         246742 non-null  object        
dtypes: datetime64[ns](1), float64(1), int64(5), object(4)
memory usage: 22.6+ MB
```

```
df.isnull().sum()
```

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

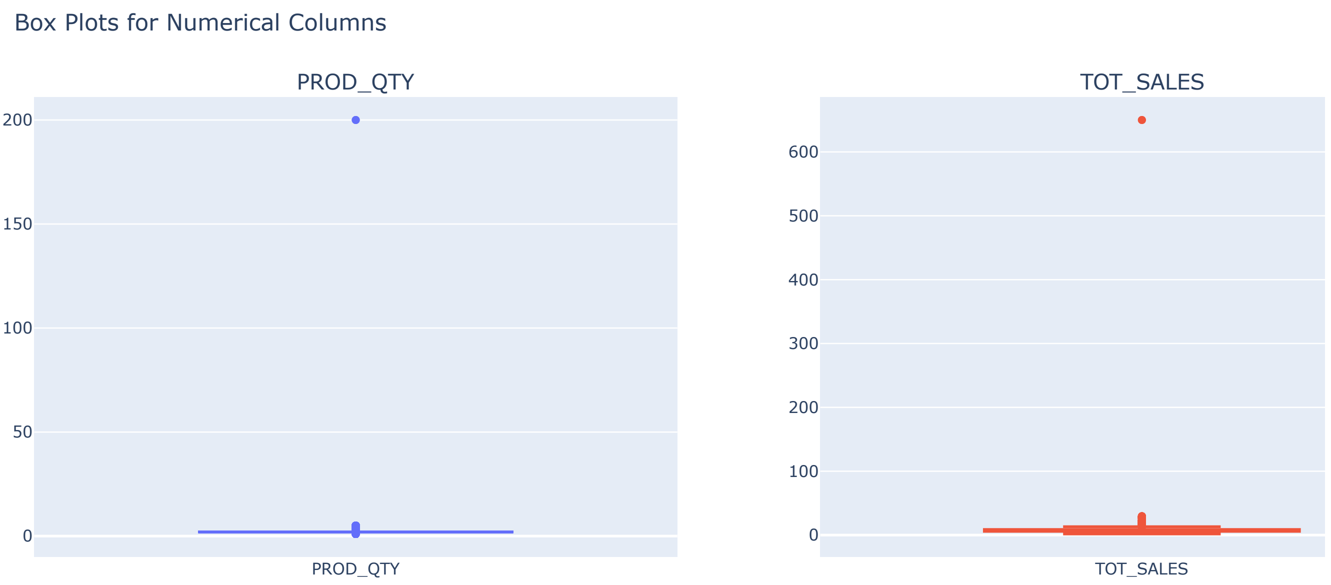
```
df.describe()
```

	LYLTY_CARD_NBR	STORE_NBR	TXN_ID	PROD_NBR	PROD_QTY	TOT_SALES
count	2.467420e+05	246742.000000	2.467420e+05	246742.000000	246742.000000	246742.000000
mean	1.355310e+05	135.051098	1.351311e+05	56.351789	1.908062	7.321322
std	8.071528e+04	76.787096	7.814772e+04	33.695428	0.659831	3.077828
min	1.000000e+03	1.000000	1.000000e+00	1.000000	1.000000	1.700000
25%	7.001500e+04	70.000000	6.756925e+04	26.000000	2.000000	5.800000
50%	1.303670e+05	130.000000	1.351830e+05	53.000000	2.000000	7.400000
75%	2.030840e+05	203.000000	2.026538e+05	87.000000	2.000000	8.800000
max	2.373711e+06	272.000000	2.415841e+06	114.000000	200.000000	650.000000

```
df.sort_values(by="PROD_QTY", ascending=False).head()
```

	LYLTY_CARD_NBR	LIFESTAGE	PREMIUM_CUSTOMER	DATE	STORE_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY
69763	226000	OLDER FAMILIES	Premium	2019-05-20	226	226210	4	Dorito Corn Chp Supreme 380g	200
69762	226000	OLDER FAMILIES	Premium	2018-08-19	226	226201	4	Dorito Corn Chp Supreme 380g	200
135225	46296	RETIREES	Budget	2019-05-15	46	42138	81	Pringles Original Crisps 134g	5
69523	71142	OLDER FAMILIES	Premium	2019-05-15	71	69852	96	WW Original Stacked Chips 160g	5
69502	55144	OLDER FAMILIES	Premium	2018-08-18	55	49328	44	Thins Chips Light& Tangy 175g	5

```
# Create a box plot for 'PROD_QTY' using Plotly
fig1 = px.box(df, y='PROD_QTY', title='Box Plot for PROD_QTY')

# Create a box plot for 'TOT_SALES' using Plotly
fig2 = px.box(df, y='TOT_SALES', title='Box Plot for TOT_SALES')

# If you want to create box plots for all numerical columns, you can do so using a loop
numerical_columns = ['PROD_QTY', 'TOT_SALES']

# Create subplots for all numerical columns
fig = make_subplots ( rows=1, cols=len(numerical_columns), subplot_titles=numerical_columns)

for i, col in enumerate(numerical_columns):
    fig.add_trace(go.Box(y=df[col], name=col), row=1, col=i + 1)

fig.update_layout(title_text="Box Plots for Numerical Columns")

# Show the plots
fig.show()
```



```
ndf = df[df['LYLTY_CARD_NBR'] != 226000]
```

```
# Create a summary of transaction count by date
ndf['DATE'].describe()
```

```
count                  246740
unique                    364
top       2018-12-24 00:00:00
freq                      865
first     2018-07-01 00:00:00
last      2019-06-30 00:00:00
Name: DATE, dtype: object
```

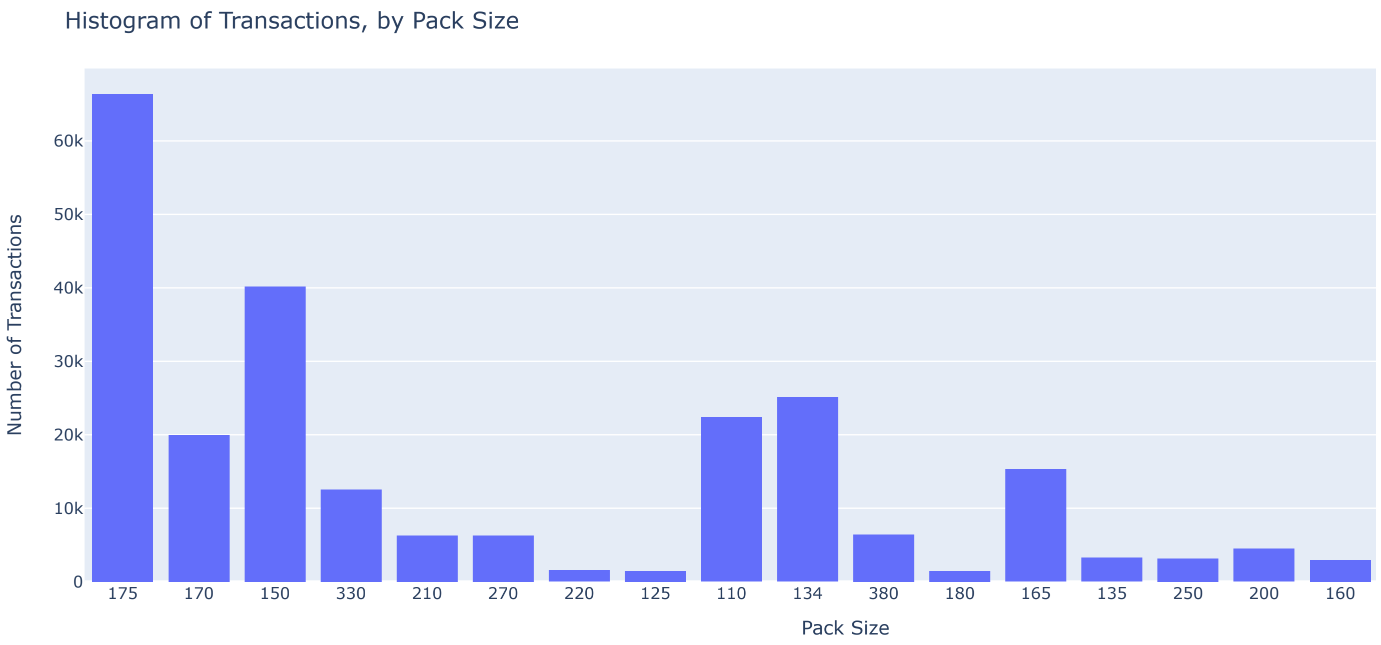
```
pd.date_range(start=ndf["DATE"].min(), end=ndf["DATE"].max()).difference(ndf["DATE"])
```

```
DatetimeIndex(['2018-12-25'], dtype='datetime64[ns]', freq=None)
```

```
# Descriptive statistics of PACK_SIZE
ndf["pack_size"].describe()
```

```
count     246740
unique        20
top          175
freq       66390
Name: pack_size, dtype: object
```

```
fig = px.histogram(ndf, x="pack_size", nbins=10)

fig.update_layout(
    title="Histogram of Transactions, by Pack Size",
    xaxis_title="Pack Size",
    yaxis_title="Number of Transactions",)

fig.show()
```



```
# Create column for brand names
ndf['Brand Name'] = ndf['PROD_NAME'].str.split(' ').str[0]
```

```
# Check for any duplication or similar brands
ndf['Brand Name'].value_counts()
```

```
Kettle        41288
Smiths        27390
Pringles      25102
Doritos       22041
Thins         14075
RRD           11894
Infuzions     11057
WW            10320
Cobs           9693
Tostitos       9471
Twisties       9454
```

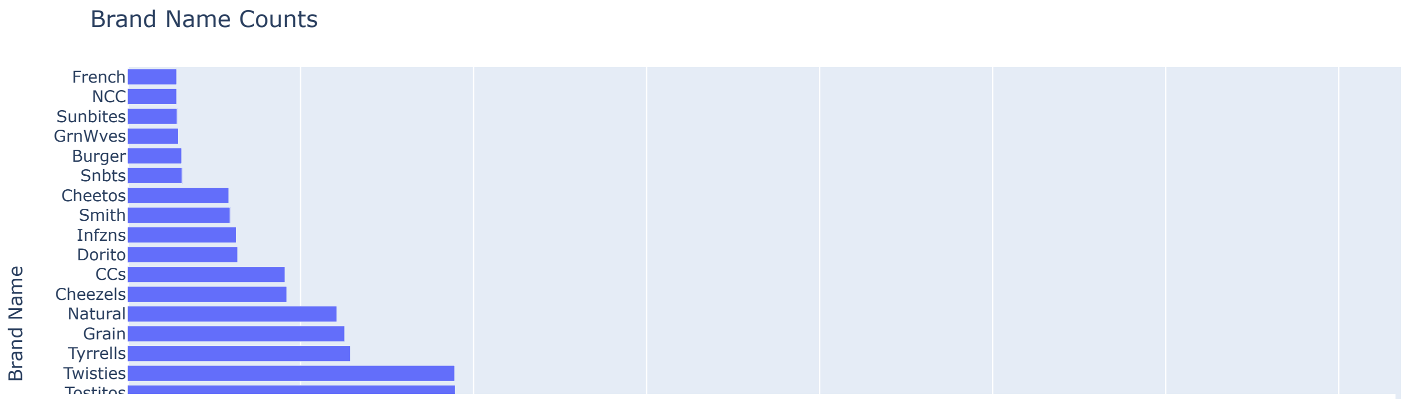
```
Tyrrells       6442
Grain          6272
Natural        6050
Cheezels       4603
CCs            4551
Red            4427
Dorito         3183
Infzns         3144
Smith          2963
Cheetos        2927
Snbts          1576
Burger         1564
Woolworths     1516
GrnWves        1468
Sunbites       1432
NCC            1419
French         1418
Name: Brand Name, dtype: int64
```

```
ndf['Brand Name'] = ndf['Brand Name'].str.replace('Red','RRD')
ndf['Brand Name'] = ndf['Brand Name'].str.replace('Woolworths','WW')
ndf['Brand Name'] = ndf['Brand Name'].str.replace('INFUZIONS','INFZNS')
ndf['Brand Name'] = ndf['Brand Name'].str.replace('SMITHS','SMITH')
ndf['Brand Name'] = ndf['Brand Name'].str.replace('SUNBITES','SNBTS')
ndf['Brand Name'] = ndf['Brand Name'].str.replace('DORITOS','DORITO')
ndf['Brand Name'] = ndf['Brand Name'].str.replace('GRNWVES','GRAIN')
```

```
ndf['Brand Name'].value_counts()
```

```
Kettle       41288
Smiths       27390
Pringles     25102
Doritos      22041
RRD          16321
Thins        14075
WW           11836
Infuzions    11057
Cobs          9693
Tostitos      9471
Twisties      9454
Tyrrells      6442
Grain         6272
Natural       6050
Cheezels      4603
CCs           4551
Dorito        3183
Infzns        3144
Smith         2963
Cheetos       2927
Snbts         1576
Burger        1564
GrnWves       1468
Sunbites      1432
NCC           1419
French        1418
Name: Brand Name, dtype: int64
```

```
fig = px.bar(ndf["Brand Name"].value_counts().reset_index(), x="Brand Name", y="index", orientation="h")

fig.update_layout(
    title="Brand Name Counts",
    xaxis_title="Count",
    yaxis_title="Brand Name",)

fig.show()
```



-Who spends the most on chips (total sales), describing customers by lifestage

-How premium their general purchasing behaviour is

-How many customers are in each segment

-How many chips are bought per customer by segment

-What's the average chip price by customer segment

```
grouped_sales = pd.DataFrame(ndf.groupby(["LIFESTAGE", "PREMIUM_CUSTOMER"])["TOT_SALES"].agg(["sum", "mean"]))
grouped_sales.sort_values(ascending=False, by="sum")
```

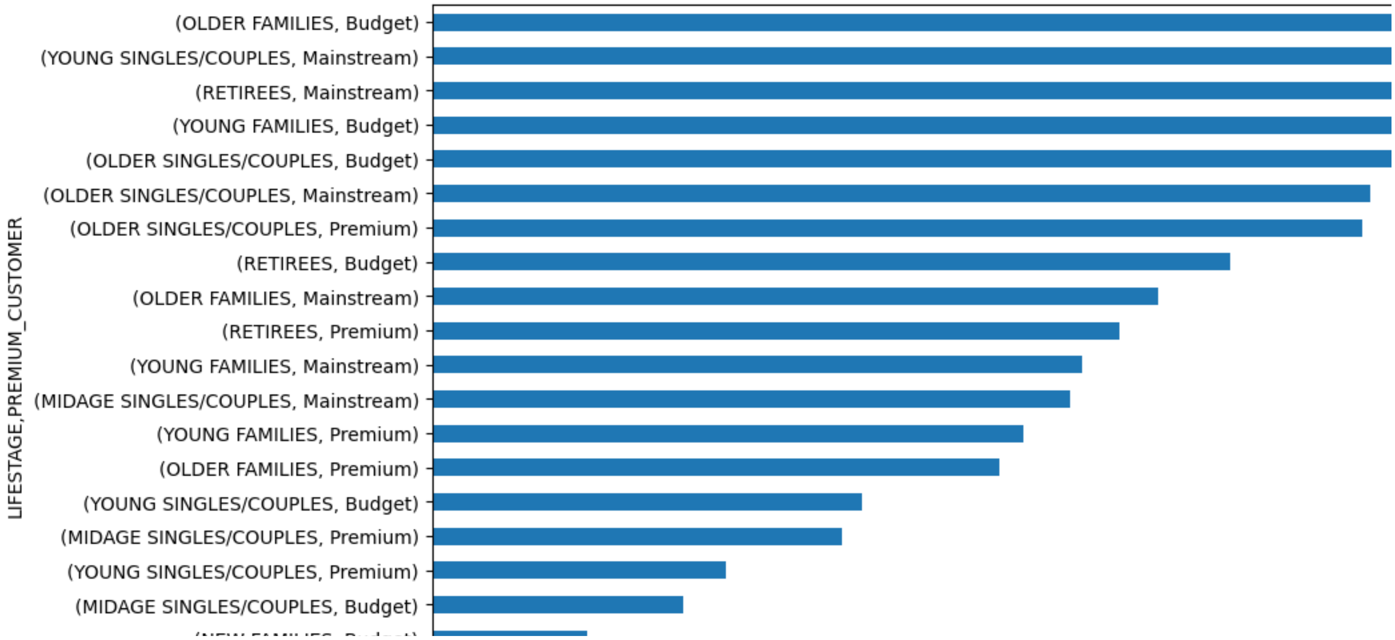
		sum	mean
LIFESTAGE	PREMIUM_CUSTOMER		
OLDER FAMILIES	Budget	156863.75	7.291241
YOUNG SINGLES/COUPLES	Mainstream	147582.20	7.551279
RETIREES	Mainstream	145168.95	7.269352
YOUNG FAMILIES	Budget	129717.95	7.302705
OLDER SINGLES/COUPLES	Budget	127833.60	7.444305
	Mainstream	124648.50	7.306049
	Premium	123537.55	7.459997
RETIREES	Budget	105916.30	7.445786
OLDER FAMILIES	Mainstream	96413.55	7.281440
RETIREES	Premium	91296.65	7.461315
YOUNG FAMILIES	Mainstream	86338.25	7.226772
MIDAGE SINGLES/COUPLES	Mainstream	84734.25	7.637156
YOUNG FAMILIES	Premium	78571.70	7.285951
OLDER FAMILIES	Premium	75242.60	7.232779
YOUNG SINGLES/COUPLES	Budget	57122.10	6.663023
MIDAGE SINGLES/COUPLES	Premium	54443.85	7.152371
YOUNG SINGLES/COUPLES	Premium	39052.30	6.673325
MIDAGE SINGLES/COUPLES	Budget	33345.70	7.108442
NEW FAMILIES	Budget	20607.45	7.297256
	Mainstream	15979.70	7.313364
	Premium	10760.80	7.231720

```
grouped_sales["sum"].sum()
```

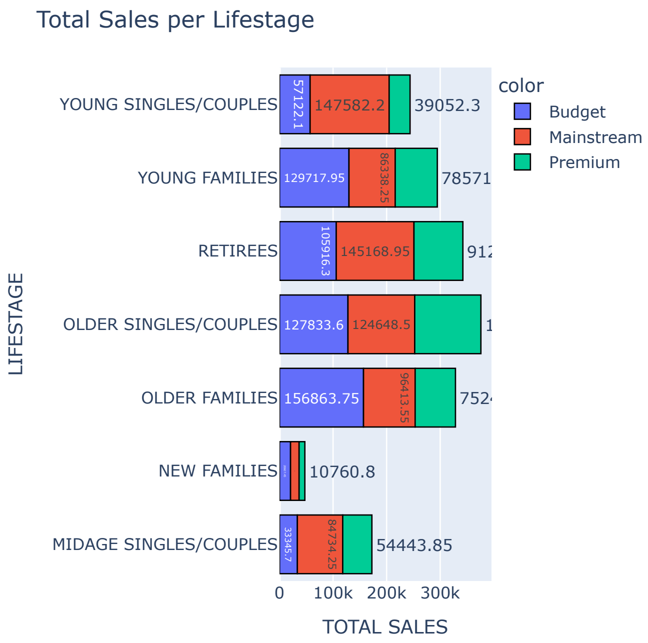
```
1805177.7
```

```
grouped_sales["sum"].sort_values().plot.barh(figsize=(12,7))
```

```
<Axes: ylabel='LIFESTAGE,PREMIUM_CUSTOMER'>
```



```
fig = px.bar(grouped_sales, x="sum", y=grouped_sales.index.get_level_values("LIFESTAGE"),
             color=grouped_sales.index.get_level_values("PREMIUM_CUSTOMER"),
             orientation='h', text=grouped_sales["sum"])

fig.update_traces(marker_line_width=1, marker_line_color="black")
fig.update_layout(title="Total Sales per Lifestage", xaxis_title="TOTAL SALES", yaxis_title="LIFESTAGE")
fig.show()
```



```
stage_agg_prem = ndf.groupby("LIFESTAGE")["PREMIUM_CUSTOMER"].agg(pd.Series.mode).sort_values()
print("Top contributor per LIFESTAGE by PREMIUM category")
print(stage_agg_prem)
```

```
Top contributor per LIFESTAGE by PREMIUM category
LIFESTAGE
NEW FAMILIES                  Budget
OLDER FAMILIES                Budget
OLDER SINGLES/COUPLES         Budget
YOUNG FAMILIES                Budget
MIDAGE SINGLES/COUPLES    Mainstream
RETIREES                  Mainstream
```

```
YOUNG SINGLES/COUPLES     Mainstream
Name: PREMIUM_CUSTOMER, dtype: object
```

```
unique_cust = ndf.groupby(["LIFESTAGE", "PREMIUM_CUSTOMER"])["LYLTY_CARD_NBR"].nunique().sort_values(ascending=False)
pd.DataFrame(unique_cust)
```

		LYLTY_CARD_NBR
LIFESTAGE	PREMIUM_CUSTOMER	
YOUNG SINGLES/COUPLES	Mainstream	7917
RETIREES	Mainstream	6358
OLDER SINGLES/COUPLES	Mainstream	4858
	Budget	4849
	Premium	4682
OLDER FAMILIES	Budget	4611
RETIREES	Budget	4385
YOUNG FAMILIES	Budget	3953
RETIREES	Premium	3812
YOUNG SINGLES/COUPLES	Budget	3647
MIDAGE SINGLES/COUPLES	Mainstream	3298
OLDER FAMILIES	Mainstream	2788
YOUNG FAMILIES	Mainstream	2685
YOUNG SINGLES/COUPLES	Premium	2480
YOUNG FAMILIES	Premium	2398
MIDAGE SINGLES/COUPLES	Premium	2369
OLDER FAMILIES	Premium	2231
MIDAGE SINGLES/COUPLES	Budget	1474
NEW FAMILIES	Budget	1087
	Mainstream	830
	Premium	575

```
unique_cust.sort_values().plot.barh(figsize=(12,7))
```

```
freq_per_cust = ndf.groupby(["LYLTY_CARD_NBR", "LIFESTAGE", "PREMIUM_CUSTOMER"]).count()["DATE"]
freq_per_cust.groupby(["LIFESTAGE", "PREMIUM_CUSTOMER"]).agg(["mean", "count"]).sort_values(ascending=False, by="mean")
```

		mean	count
LIFESTAGE	PREMIUM_CUSTOMER		
OLDER FAMILIES	Mainstream	4.749283	2788
	Budget	4.665799	4611
	Premium	4.662931	2231
YOUNG FAMILIES	Premium	4.497081	2398
	Budget	4.493549	3953
	Mainstream	4.449534	2685
OLDER SINGLES/COUPLES	Budget	3.541349	4849
	Premium	3.536950	4682
	Mainstream	3.511939	4858
MIDAGE SINGLES/COUPLES	Mainstream	3.364160	3298
RETIREES	Budget	3.244014	4385
MIDAGE SINGLES/COUPLES	Premium	3.213170	2369
RETIREES	Premium	3.209864	3812
MIDAGE SINGLES/COUPLES	Budget	3.182497	1474
RETIREES	Mainstream	3.140925	6358
NEW FAMILIES	Mainstream	2.632530	830
	Budget	2.597976	1087
	Premium	2.587826	575
YOUNG SINGLES/COUPLES	Mainstream	2.468612	7917
	Premium	2.359677	2480
	Budget	2.350699	3647

```
grouped_sales.sort_values(ascending=False, by="mean")
```

		sum	mean
LIFESTAGE	PREMIUM_CUSTOMER		

```
grouped_sales.sort_values(ascending=False, by="mean")
```

		sum	mean
LIFESTAGE	PREMIUM_CUSTOMER		
MIDAGE SINGLES/COUPLES	Mainstream	84734.25	7.637156
YOUNG SINGLES/COUPLES	Mainstream	147582.20	7.551279
RETIREES	Premium	91296.65	7.461315
OLDER SINGLES/COUPLES	Premium	123537.55	7.459997
RETIREES	Budget	105916.30	7.445786
OLDER SINGLES/COUPLES	Budget	127833.60	7.444305
NEW FAMILIES	Mainstream	15979.70	7.313364
OLDER SINGLES/COUPLES	Mainstream	124648.50	7.306049
YOUNG FAMILIES	Budget	129717.95	7.302705
NEW FAMILIES	Budget	20607.45	7.297256
OLDER FAMILIES	Budget	156863.75	7.291241
YOUNG FAMILIES	Premium	78571.70	7.285951
OLDER FAMILIES	Mainstream	96413.55	7.281440
RETIREES	Mainstream	145168.95	7.269352
OLDER FAMILIES	Premium	75242.60	7.232779
NEW FAMILIES	Premium	10760.80	7.231720
YOUNG FAMILIES	Mainstream	86338.25	7.226772
MIDAGE SINGLES/COUPLES	Premium	54443.85	7.152371
	Budget	33345.70	7.108442
YOUNG SINGLES/COUPLES	Premium	39052.30	6.673325
	Budget	57122.10	6.663023

```
ndf.groupby(["LIFESTAGE", "PREMIUM_CUSTOMER"])["Brand Name"].agg(pd.Series.mode).sort_values()
```

```
LIFESTAGE               PREMIUM_CUSTOMER
MIDAGE SINGLES/COUPLES  Budget              Kettle
YOUNG SINGLES/COUPLES   Budget              Kettle
YOUNG FAMILIES          Premium             Kettle
                        Mainstream          Kettle
                        Budget              Kettle
RETIREES                Premium             Kettle
                        Mainstream          Kettle
                        Budget              Kettle
OLDER SINGLES/COUPLES   Premium             Kettle
YOUNG SINGLES/COUPLES   Mainstream          Kettle
OLDER SINGLES/COUPLES   Mainstream          Kettle
OLDER FAMILIES          Premium             Kettle
                        Mainstream          Kettle
                        Budget              Kettle
NEW FAMILIES            Premium             Kettle
                        Mainstream          Kettle
                        Budget              Kettle
MIDAGE SINGLES/COUPLES  Premium             Kettle
                        Mainstream          Kettle
OLDER SINGLES/COUPLES   Budget              Kettle
YOUNG SINGLES/COUPLES   Premium             Kettle
Name: Brand Name, dtype: object
```

```
# Get unique LIFESTAGE and PREMIUM_CUSTOMER combinations
lifestages = ndf["LIFESTAGE"].unique()
customers = ndf["PREMIUM_CUSTOMER"].unique()

# Set the number of columns for each row of plots
```

```
num_cols = 2

# Create subplots
fig, axs = plt.subplots(len(lifestages), len(customers), figsize=(12, 12))

for i, stage in enumerate(lifestages):
    for j, prem in enumerate(customers):
        print('==========', stage, '-', prem, '==========')
        summary = ndf[(ndf["LIFESTAGE"] == stage) & (ndf["PREMIUM_CUSTOMER"] == prem)]["Brand Name"].value_counts().head(3)
        print(summary)
        ax = axs[i, j]
        summary.plot.barh(ax=ax)
        ax.set_title(f'{stage} - {prem}')
        ax.set_xlabel('Count')

# Adjust layout
plt.tight_layout()

# Show the plots
plt.show()
```

```
temp = ndf.reset_index().rename(columns = {"index": "transaction"})
temp["Segment"] = temp["LIFESTAGE"] + ' - ' + temp['PREMIUM_CUSTOMER']
```

```
segment_brand_encode = pd.concat([pd.get_dummies(temp["Segment"]), pd.get_dummies(temp["Brand Name"])], axis=1)
```

```
    Kettle      838
```

```
frequent_sets = apriori(segment_brand_encode, min_support=0.01, use_colnames=True)
rules = association_rules(frequent_sets, metric="lift", min_threshold=1)
```

```
    ========== YOUNG SINGLES/COUPLES - Budget ==========
```

```
set_temp = temp["Segment"].unique()
rules[rules["antecedents"].apply(lambda x: list(x)).apply(lambda x: x in set_temp)]
```

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage
0	(OLDER FAMILIES - Budget)	(Smiths)	0.087193	0.111008	0.010700	0.122711	1.105428	0.001020
3	(OLDER SINGLES/COUPLES - Budget)	(Kettle)	0.069596	0.167334	0.012422	0.178488	1.066658	0.000776
4	(OLDER SINGLES/COUPLES - Premium)	(Kettle)	0.067115	0.167334	0.011944	0.177959	1.063495	0.000713
7	(RETIREES - Budget)	(Kettle)	0.057652	0.167334	0.010505	0.182214	1.088926	0.000858
8	(RETIREES - Mainstream)	(Kettle)	0.080935	0.167334	0.013723	0.169554	1.013269	0.000180
10	(YOUNG SINGLES/COUPLES - Mainstream)	(Kettle)	0.079209	0.167334	0.015579	0.196684	1.175400	0.002325

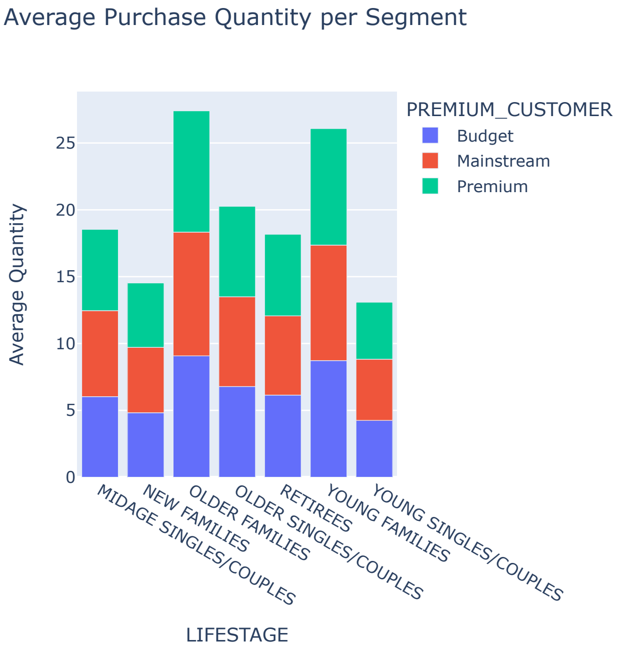
```
    Name: Brand Name, dtype: int64
```

```
# Create an empty DataFrame to store the summary data
summary_table = pd.DataFrame(columns=["LIFESTAGE", "PREMIUM_CUSTOMER", "Top 3 Pack Sizes"])

# Iterate over LIFESTAGE and PREMIUM_CUSTOMER
for stage in ndf["LIFESTAGE"].unique():
    for prem in ndf["PREMIUM_CUSTOMER"].unique():
        print('==========', stage, '-', prem, '==========')
        subset = ndf[(ndf["LIFESTAGE"] == stage) & (ndf["PREMIUM_CUSTOMER"] == prem)]

        if not subset.empty:
            summary = subset["pack_size"].value_counts().head(3).sort_index()
            print(summary)
            summary_str = ", ".join([f"{size}: {count}" for size, count in summary.items()])
```

```
========== YOUNG SINGLES/COUPLES - Premium ==========
134     537
150     933
175    1618
Name: pack_size, dtype: int64
========== YOUNG SINGLES/COUPLES - Budget ==========
134     832
150    1390
175    2338
Name: pack_size, dtype: int64
========== YOUNG SINGLES/COUPLES - Mainstream ==========
134    2315
150    3080
175    4997
Name: pack_size, dtype: int64
========== MIDAGE SINGLES/COUPLES - Premium ==========
134     781
150    1207
175    2082
Name: pack_size, dtype: int64
========== MIDAGE SINGLES/COUPLES - Budget ==========
134     449
150     771
175    1277
Name: pack_size, dtype: int64
========== MIDAGE SINGLES/COUPLES - Mainstream ==========
134    1159
150    1777
175    2975
Name: pack_size, dtype: int64
========== NEW FAMILIES - Premium ==========
134    165
```

```
150    233
175    376
Name: pack_size, dtype: int64
========== NEW FAMILIES - Budget ==========
134    309
150    440
175    777
Name: pack_size, dtype: int64
========== NEW FAMILIES - Mainstream ==========
134    224
150    374
175    589
Name: pack_size, dtype: int64
========== OLDER FAMILIES - Premium ==========
134    1014
150    1673
175    2816
Name: pack_size, dtype: int64
========== OLDER FAMILIES - Budget ==========
134    1996
150    3588
175    5808
Name: pack_size, dtype: int64
========== OLDER FAMILIES - Mainstream ==========
134    1234
150    2189
```

```
# Calculate the average purchase quantity per segment
avg_quantity = (temp.groupby(["LIFESTAGE", "PREMIUM_CUSTOMER"])["PROD_QTY"].sum() / temp.groupby(["LIFESTAGE", "PREMIUM_CUSTOMER"])["LYLTY_CA

# Create a bar plot with Plotly
fig = px.bar(avg_quantity, x=avg_quantity.index, y=avg_quantity.columns, title="Average Purchase Quantity per Segment")
fig.update_xaxes(title="LIFESTAGE")
fig.update_yaxes(title="Average Quantity")

# Show the plot
fig.show()
```



Insights:

Top 3 total sales contributor segments are:

1. **Older Families (Budget)** with total sales of $156,864.
2. **Young Singles/Couples (Mainstream)** with total sales of $147,582.
3. **Retirees (Mainstream)** with total sales of $145,169.

Population Distribution:

- **Young Singles/Couples (Mainstream)** has the highest population, followed by **Retirees (Mainstream)**. This explains their high total sales.
- Despite **Older Families** not having the highest population, they have the highest frequency of purchase, contributing to their high total sales.
- **Older Families** followed by **Young Families** have the highest average quantity of chips bought per purchase.
- The Mainstream category of the "Young and Midage Singles/Couples" has the highest spending on chips per purchase. The difference from the non-Mainstream "Young and Midage Singles/Couples" is statistically significant.

Brand Preference:

- **Kettle** dominates every segment as the most purchased brand.
- Among the segments, "Young and Midage Singles/Couples" is the only one with a different preference, favoring **Doritos** as their 2nd most purchased brand (after Kettle).

Preferred Chip Sizes:

- The most frequently purchased chip size across all segments is 175g, followed by the 150g chip size.

Recommendations:

1. **Older Families:**
   - Focus on the Budget segment.
   - Leverage their frequent purchases through promotions that encourage more frequent buying.
   - Take advantage of their tendency to buy a high quantity of chips per visit by offering promotions that encourage larger purchases.
2. **Young Singles/Couples:**
   - Focus on the Mainstream segment.
   - Collaborate with Doritos to create targeted branding promotions for the "Young Singles/Couples - Mainstream" segment, considering their unique brand preference.
   - Capitalize on their large population by ensuring promotions effectively reach this segment.
3. **Retirees:**
   - Focus on the Mainstream segment.
   - Given their substantial population, prioritize efforts to ensure that promotions reach as many of them as possible and are frequent.

General Recommendations:

- Across all segments, Kettle is the most frequently purchased brand, and the 175g (regardless of brand) followed by the 150g is the preferred chip size.
- When promoting chips to all segments, consider leveraging the popularity of Kettle and the preference for 175g and 150g chip sizes.

These recommendations are based on the observed patterns and preferences within each segment and can help tailor marketing and promotional strategies effectively.