Quantium Data Analytics Project

Section 1

Import packages and read datafiles

In [458]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from plotly import __version__
from plotly.offline import download_plotlyjs, init_notebook_mode, plot, iplot
import cufflinks as cf
%matplotlib inline

from datetime import datetime
import xlrd

from collections import Counter

from scipy.stats import ttest_ind

from apyori import apriori
from mlxtend.frequent_patterns import apriori
from mlxtend.frequent_patterns import association_rules
```

In [224]:
```
customer = pd.read_csv('QVI_purchase_behaviour.csv')
transaction = pd.read_excel('QVI_transaction_data.xlsx')
```

Exploratory Data Analysis

Data Preprocessing

In [225]:
```
customer = customer.dropna()
transaction = transaction.dropna()
```

Examine transaction data

Convert Excel Date into Python Date

In [255]:
```
transaction['DATE'] = transaction['DATE'].apply(lambda s: xlrd.xldate.xldate_as_d
transaction
```

Out[255]:

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

264836 rows × 9 columns

Discover the most common words in product names

In [256]:
```
# Remove special characters in product names

import re

product = transaction['PROD_NAME']

cleaned_name = []
for string in product:
    string = re.sub(r'\\.','', string)       # Remove all \n \t etc..
    string = re.sub(r'[^\w\s]*','', string)  # Remove anything not a digit, lette

    cleaned_name.append(string)

transaction['PROD_NAME2'] = cleaned_name
```

In [257]:
```
unique_products = []
for p in transaction['PROD_NAME2']:
    if p not in unique_products:
        unique_products.append(p)
```

In [258]:
```
# Count the most common words in all product names
count_lists = []

for w in unique_products:
    word = w.split()[:-1]
    count_lists.append(word)


counter = Counter(count_lists[0])
for i in count_lists[1:]:
    counter.update(i)

counter.most_common(10)
```

Out[258]:
```
[('Chips', 21),
 ('Smiths', 16),
 ('Crinkle', 14),
 ('Cut', 14),
 ('Kettle', 13),
 ('Cheese', 12),
 ('Salt', 11),
 ('Original', 10),
 ('Chip', 9),
 ('Salsa', 9)]
```

Check for outliers

In [259]:
```
sort_by_quant1 = transaction.sort_values('PROD_QTY',ascending=False)
sort_by_quant1.head()
```

Out[259]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	T
69762	2018-08-19	226	226000	226201	4	Dorito Corn Chp Supreme 380g	200	
69763	2019-05-20	226	226000	226210	4	Dorito Corn Chp Supreme 380g	200	
217237	2019-05-18	201	201060	200202	26	Pringles Sweet&Spcy BBQ 134g	5	
238333	2018-08-14	219	219004	218018	25	Pringles SourCream Onion 134g	5	
238471	2019-05-19	261	261331	261111	87	Infuzions BBQ Rib Prawn Crackers 110g	5	

In [260]:
```
# There are two transactions where 200 packets of chips are bought in one transac
# and both of these transactions were by the same customer.

# It looks like this customer has only had the two transactions over the year
# and is not an ordinary retail customer. The customer might be buying chips for
# We'll remove this loyalty card number from further analysis.![image.png]
```

Filtering out outliers

In [261]:
```
i = transaction.loc[transaction['PROD_QTY']>50].index
transaction_new = transaction.drop(i)
transaction_new.head()
```

Out[261]:

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

In [262]:
```
sort_by_quant2 = transaction_new.sort_values('PROD_QTY',ascending=False)
sort_by_quant2.head()
```

Out[262]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY
5415	2018-08-20	236	236116	239252	12	Natural Chip Co Tmato Hrb&Spce 175g	5
32796	2019-05-18	236	236033	238735	59	Old El Paso Salsa Dip Tomato Med 300g	5
5107	2018-08-17	54	54225	48172	46	Kettle Original 175g	5
80732	2019-05-18	49	49309	45816	30	Doritos Corn Chips Cheese Supreme 170g	5
32762	2018-08-19	227	227046	228561	100	Smiths Crinkle Cut Chips Chs&Onion170g	5

Select only the "chips" products to evaluate

In [263]:
```
j = transaction.loc[transaction['PROD_NAME'].str.contains("Chips", na=False)].inc
chips = transaction.iloc[j]
chips.head()
```

Out[263]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	TOT_
2	2019-05-20	1	1343	383	61	Smiths Crinkle Cut Chips Chicken 170g	2	
6	2019-05-16	4	4149	3333	16	Smiths Crinkle Chips Salt & Vinegar 330g	1	
10	2019-05-17	7	7215	7176	16	Smiths Crinkle Chips Salt & Vinegar 330g	1	
14	2019-05-15	19	19272	16686	44	Thins Chips Light& Tangy 175g	1	
33	2019-05-18	45	45220	41651	22	Thins Chips Originl saltd 175g	1	

Count number of transactions by date

In [264]:
```
transQuant = chips.groupby('DATE').sum()[['PROD_QTY','TOT_SALES']]
transQuant
# There's only 364 rows, meaning only 364 dates which indicates a missing date.
# Let's create a sequence of dates from 1 Jul 2018 to 30 Jun 2019 and use this to
# chart of number of transactions over time to find the missing date.
```

Out[264]:

	PROD_QTY	TOT_SALES
DATE		
2018-07-01	230	787.9
2018-07-02	250	905.6
2018-07-03	262	912.9
2018-07-04	227	758.2
2018-07-05	254	876.6
...	...	...
2019-06-26	241	860.3
2019-06-27	242	831.8
2019-06-28	307	1074.9
2019-06-29	264	933.3
2019-06-30	288	997.4

364 rows × 2 columns

In [265]:
```
transCount = chips.groupby('DATE').count()['PROD_QTY']
transCount
```

Out[265]:
```
DATE
2018-07-01    121
2018-07-02    129
2018-07-03    136
2018-07-04    119
2018-07-05    134
             ...
2019-06-26    127
2019-06-27    127
2019-06-28    159
2019-06-29    139
2019-06-30    149
Name: PROD_QTY, Length: 364, dtype: int64
```

```
In [266]: trans_all = pd.merge(transQuant,transCount, on = 'DATE')
          trans_all.rename(columns={'PROD_QTY_y': 'TRANS_COUNT'}, inplace=True)
          trans_all
```

Out[266]:

	PROD_QTY_x	TOT_SALES	TRANS_COUNT
DATE			
2018-07-01	230	787.9	121
2018-07-02	250	905.6	129
2018-07-03	262	912.9	136
2018-07-04	227	758.2	119
2018-07-05	254	876.6	134
...	...	...	...
2019-06-26	241	860.3	127
2019-06-27	242	831.8	127
2019-06-28	307	1074.9	159
2019-06-29	264	933.3	139
2019-06-30	288	997.4	149

364 rows × 3 columns

Create a dataframe of all dates range from 2018-07-01 to 2019-06-30,

and then join it with the count of transactions by date

In [267]:
```
alldates = pd.DataFrame(pd.date_range(start="2018-07-01",end="2019-06-30"), colu
alldates
```

Out[267]:

	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 × 1 columns

In [268]:
```
transdates = pd.merge(alldates, trans_all, on='DATE', how = 'left')
#transdates['PROD_QTY'] = transdates['PROD_QTY'].fillna(0)
transdates = transdates.fillna(0)
transdates
```

Out[268]:

	DATE	PROD_QTY_x	TOT_SALES	TRANS_COUNT
0	2018-07-01	230.0	787.9	121.0
1	2018-07-02	250.0	905.6	129.0
2	2018-07-03	262.0	912.9	136.0
3	2018-07-04	227.0	758.2	119.0
4	2018-07-05	254.0	876.6	134.0
...	...	...	...	...
360	2019-06-26	241.0	860.3	127.0
361	2019-06-27	242.0	831.8	127.0
362	2019-06-28	307.0	1074.9	159.0
363	2019-06-29	264.0	933.3	139.0
364	2019-06-30	288.0	997.4	149.0

365 rows × 4 columns

Identify the date that doesn't have any transactions

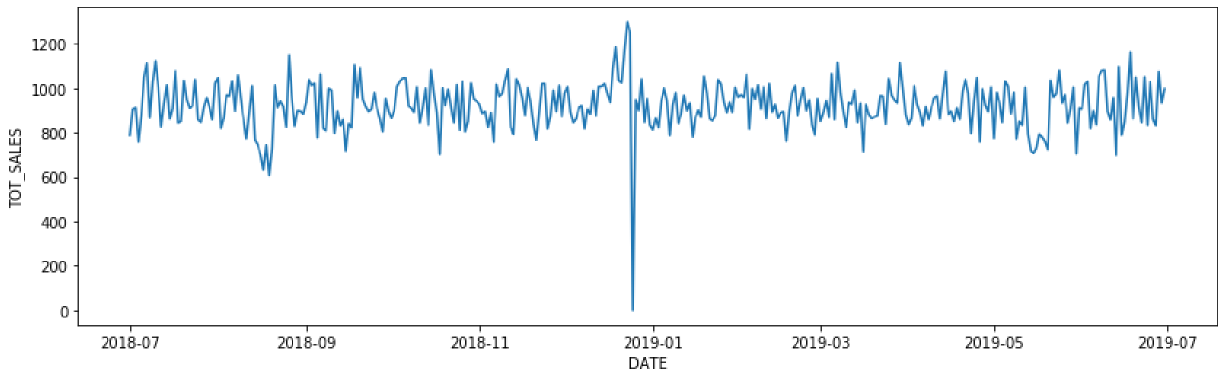
In [269]:
```
zero = transdates.loc[transdates['TOT_SALES']==0]
zero
```

Out[269]:

	DATE	PROD_QTY_x	TOT_SALES	TRANS_COUNT
177	2018-12-25	0.0	0.0	0.0

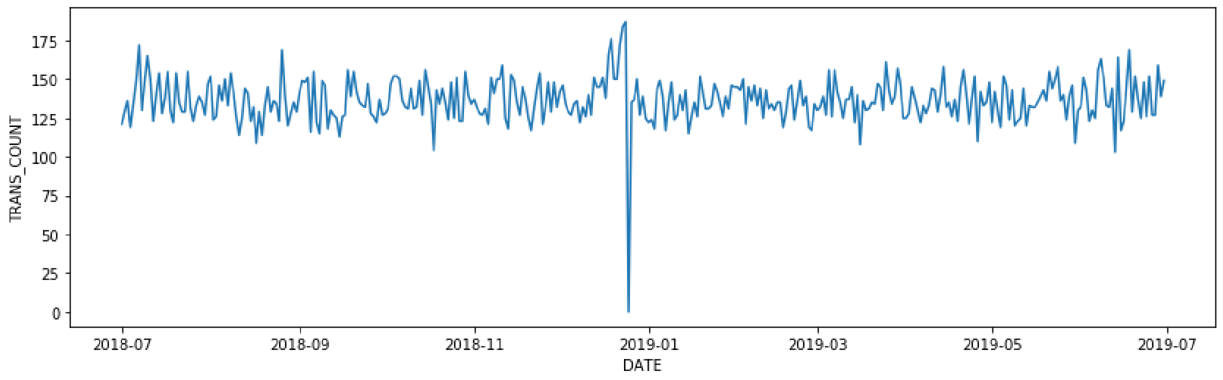
In [270]:
```
plt.figure(figsize=(14,4))

sns.lineplot(x='DATE',y='TOT_SALES',data=transdates)
```

Out[270]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x13f65bbc3c8>
```



In [271]:
```
plt.figure(figsize=(14,4))
sns.lineplot(x='DATE',y='TRANS_COUNT',data=transdates)
```

Out[271]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x13f4c72bb48>
```



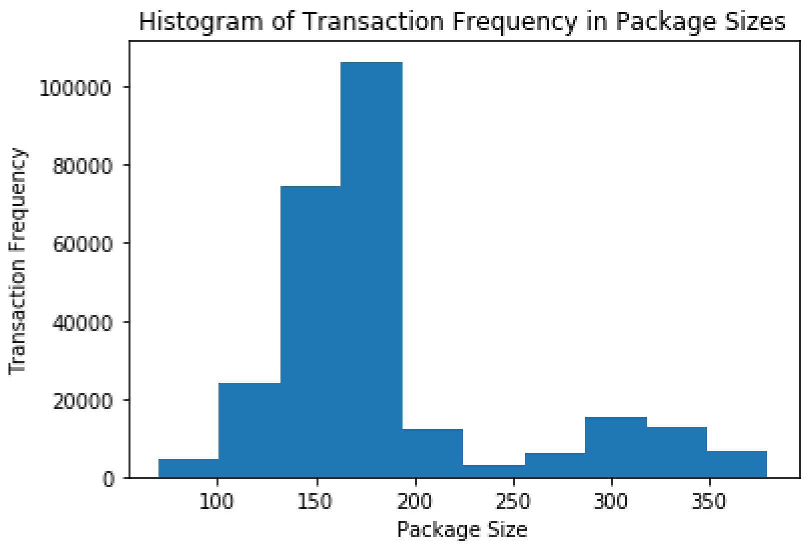
In [272]:
```
# We can see that the increase in sales occurs in the lead-up to Christmas and th
# there are zero sales on Christmas day itself. This is due to shops being closed
# Christmas day.
```

Create another feature - Package Size

```
In [273]: transaction_new['PACK_SIZE'] = transaction_new['PROD_NAME'].str.extract('(\d+)')
          transaction_new['PACK_SIZE'] = transaction_new['PACK_SIZE'].astype(int)
```

```
In [274]: transaction_new['PACK_SIZE'].max()   # Maximum: 380
          transaction_new['PACK_SIZE'].min()   # Minimum: 70

Out[274]: 70
```

```
In [275]: hist = plt.hist(transaction_new['PACK_SIZE'])
          hist = plt.xlabel('Package Size')
          hist = plt.ylabel('Transaction Frequency')
          hist = plt.title('Histogram of Transaction Frequency in Package Sizes')
```



Create another feature - Brand

In [276]:
```
brandlist = []
for b in transaction_new['PROD_NAME']:
    brand = b.split()[0]
    brandlist.append(brand.upper())
transaction_new['BRAND'] = brandlist
transaction_new.head(40)
```

29	2019-05-20	43	43110	39342	31	Infzns Crn Crnchers Tangy Gcamole 110g	1
30	2019-05-16	43	43147	39608	99	Pringles Sthrn FriedChicken 134g	1
31	2019-05-15	43	43227	40186	26	Pringles Sweet&Spcy BBQ 134g	4
32	2019-05-20	45	45127	41122	64	Red Rock Deli SR Salsa & Mzzrlla 150g	2
33	2019-05-18	45	45220	41651	22	Thins Chips Originl saltd 175g	1
34	2018-08-16	51	51100	46802	48	Red Rock Deli Sp Salt & Truffle 150G	1

In [277]:
```
transaction_new['BRAND'] = transaction_new['BRAND'].replace('RED','RDD')
transaction_new['BRAND'] = transaction_new['BRAND'].replace('"SNBTS','SUNBITES')
transaction_new['BRAND'] = transaction_new['BRAND'].replace('INFZNS','INFUZIONS'
transaction_new['BRAND'] = transaction_new['BRAND'].replace('WW','WOOLWORTHS')
transaction_new['BRAND'] = transaction_new['BRAND'].replace('SMITH','SMITHS')
transaction_new['BRAND'] = transaction_new['BRAND'].replace('NCC','NATURAL')
transaction_new['BRAND'] = transaction_new['BRAND'].replace('DORITO','DORITOS')
transaction_new['BRAND'] = transaction_new['BRAND'].replace('GRAIN','GRNWVES')
```

In [278]:
```
transaction_new.head()
```

Out[278]:

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

In [ ]:

In [ ]:

Examine customer data

In [432]:
```
customer.groupby('LIFESTAGE').count().sort_values('LYLTY_CARD_NBR', ascending = F
```

Out[432]:

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

```
In [433]: customer.groupby('PREMIUM_CUSTOMER').count().sort_values('LYLTY_CARD_NBR', ascend
```

```
Out[433]:
```

PREMIUM_CUSTOMER	LYLTY_CARD_NBR	LIFESTAGE
Mainstream	29245	29245
Budget	24470	24470
Premium	18922	18922

In [434]:
```
all_data = pd.merge(customer, transaction_new, on='LYLTY_CARD_NBR', how='inner')
all_data
```

Out[434]:

	LYLTY_CARD_NBR	LIFESTAGE	PREMIUM_CUSTOMER	DATE	STORE_NBR	TXN_I
0	1000	YOUNG SINGLES/COUPLES	Premium	2018-10-17	1	
1	1002	YOUNG SINGLES/COUPLES	Mainstream	2018-09-16	1	
2	1003	YOUNG FAMILIES	Budget	2019-03-07	1	
3	1003	YOUNG FAMILIES	Budget	2019-03-08	1	
4	1004	OLDER SINGLES/COUPLES	Mainstream	2018-11-02	1	
...	...	...	...	...	...	..
264829	2370701	YOUNG FAMILIES	Mainstream	2018-12-08	88	24037
264830	2370751	YOUNG FAMILIES	Premium	2018-10-01	88	24039
264831	2370961	OLDER FAMILIES	Budget	2018-10-24	88	24048
264832	2370961	OLDER FAMILIES	Budget	2018-10-27	88	24048
264833	2373711	YOUNG SINGLES/COUPLES	Mainstream	2018-12-14	88	24181

264834 rows × 13 columns

In [435]:
```
Tot_by_customer = all_data.groupby(['LIFESTAGE','PREMIUM_CUSTOMER']).sum()[['PROD
Tot_by_customer.head()
```

Out[435]:

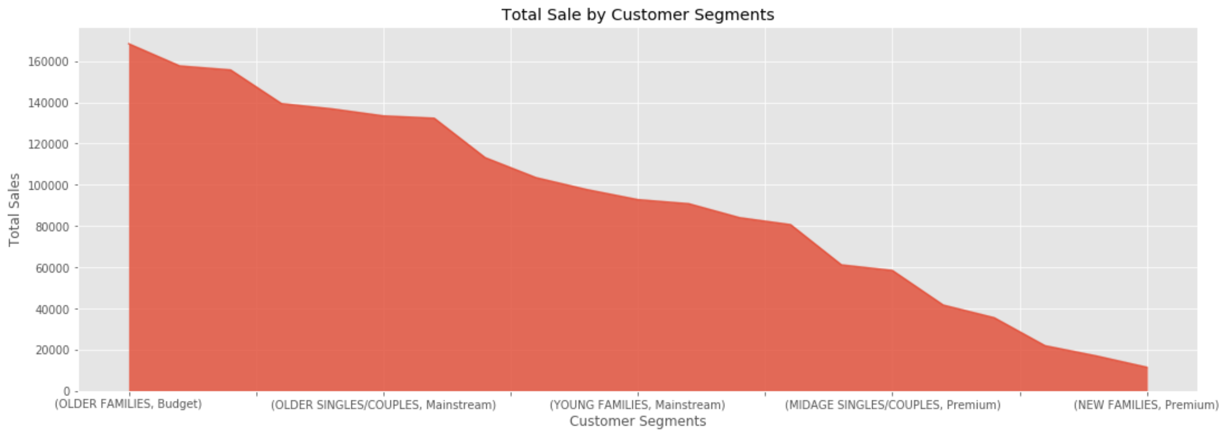
LIFESTAGE	PREMIUM_CUSTOMER	PROD_QTY	TOT_SALES
OLDER FAMILIES	**Budget**	45065	168363.25
YOUNG SINGLES/COUPLES	**Mainstream**	38632	157621.60
RETIREES	**Mainstream**	40518	155677.05
YOUNG FAMILIES	**Budget**	37111	139345.85
OLDER SINGLES/COUPLES	**Budget**	35220	136769.80

In [436]:
```
# Sales are coming mainly from Budget - older families,
#                               Mainstream - youngsingles/couples,
#                           and Mainstream - retirees
```

In [497]:
```
Tot_by_Lifestage = all_data.groupby(['LIFESTAGE','PREMIUM_CUSTOMER']).sum()['TOT_
Tot_by_Lifestage
```

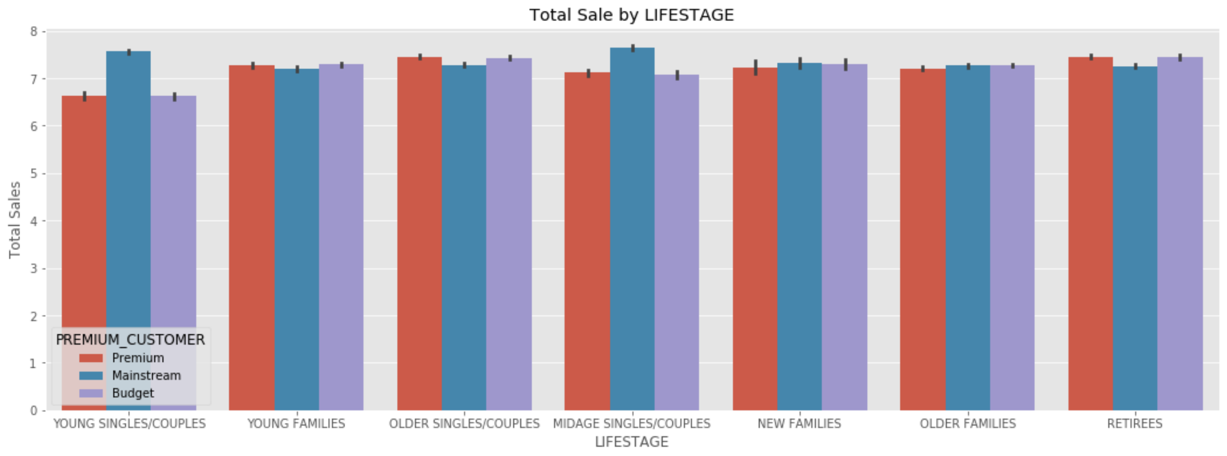
Out[497]:
```
LIFESTAGE               PREMIUM_CUSTOMER
MIDAGE SINGLES/COUPLES  Budget               35514.80
                        Mainstream           90803.85
                        Premium              58432.65
NEW FAMILIES            Budget               21928.45
                        Mainstream           17013.90
                        Premium              11491.10
OLDER FAMILIES          Budget              168363.25
                        Mainstream          103445.55
                        Premium              80658.40
OLDER SINGLES/COUPLES   Budget              136769.80
                        Mainstream          133393.80
                        Premium             132263.15
RETIREES                Budget              113147.80
                        Mainstream          155677.05
                        Premium              97646.05
YOUNG FAMILIES          Budget              139345.85
                        Mainstream           92788.75
                        Premium              84025.50
YOUNG SINGLES/COUPLES   Budget               61141.60
                        Mainstream          157621.60
                        Premium              41642.10
Name: TOT_SALES, dtype: float64
```

In [438]:
```
plt.style.use('ggplot')
plt.figure(figsize=(18,6))

Tot = Tot_by_customer['TOT_SALES'].plot.area(alpha=0.8)

Tot = plt.xlabel('Customer Segments')
Tot = plt.ylabel('Total Sales')
Tot = plt.title('Total Sale by Customer Segments')
```



In [439]:
```
plt.figure(figsize=(18,6))
tot_lifestage = sns.barplot(x='LIFESTAGE',y='TOT_SALES', hue = 'PREMIUM_CUSTOMER'

tot_lifestage.set_xlabel('LIFESTAGE')
tot_lifestage.set_ylabel('Total Sales')
tot_lifestage.set_title('Total Sale by LIFESTAGE')
```

Out[439]:
```
Text(0.5, 1.0, 'Total Sale by LIFESTAGE')
```



In [441]:
```
all_data['AVG_UNIT'] = all_data['PROD_QTY']/all_data['LYLTY_CARD_NBR']
```

In [442]:
```
sum_qt = all_data.groupby(['LIFESTAGE','PREMIUM_CUSTOMER']).sum()['PROD_QTY']
```

In [443]:
```
nunique = all_data.groupby(['LIFESTAGE','PREMIUM_CUSTOMER']).nunique()['LYLTY_CAF
```

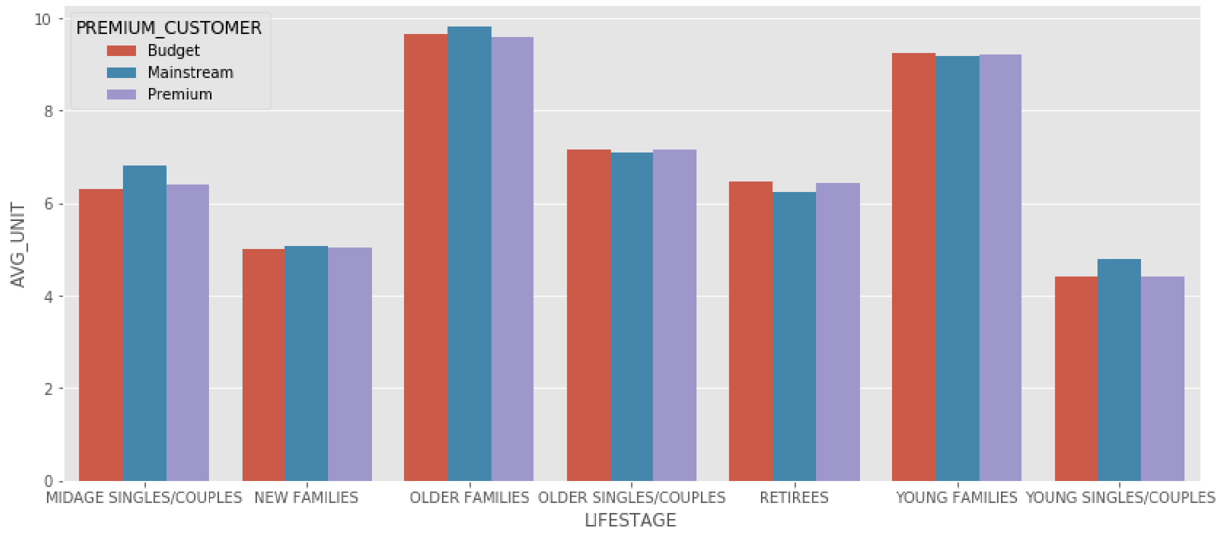
In [452]:
```
combine = pd.merge(sum_qt,nunique, on=('LIFESTAGE','PREMIUM_CUSTOMER'))
combine['AVG_UNIT'] = combine['PROD_QTY']/combine['LYLTY_CARD_NBR']
combine.reset_index(inplace=True)
combine.head()
```

Out[452]:

	LIFESTAGE	PREMIUM_CUSTOMER	PROD_QTY	LYLTY_CARD_NBR	AVG_UNIT
0	MIDAGE SINGLES/COUPLES	Budget	9496	1504	6.313830
1	MIDAGE SINGLES/COUPLES	Mainstream	22699	3340	6.796108
2	MIDAGE SINGLES/COUPLES	Premium	15526	2431	6.386672
3	NEW FAMILIES	Budget	5571	1112	5.009892
4	NEW FAMILIES	Mainstream	4319	849	5.087161

In [451]:
```
plt.figure(figsize=(14,6))
sns.barplot( x = 'LIFESTAGE', y = 'AVG_UNIT', hue='PREMIUM_CUSTOMER', data = comb
```

Out[451]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x13f5f85d508>
```

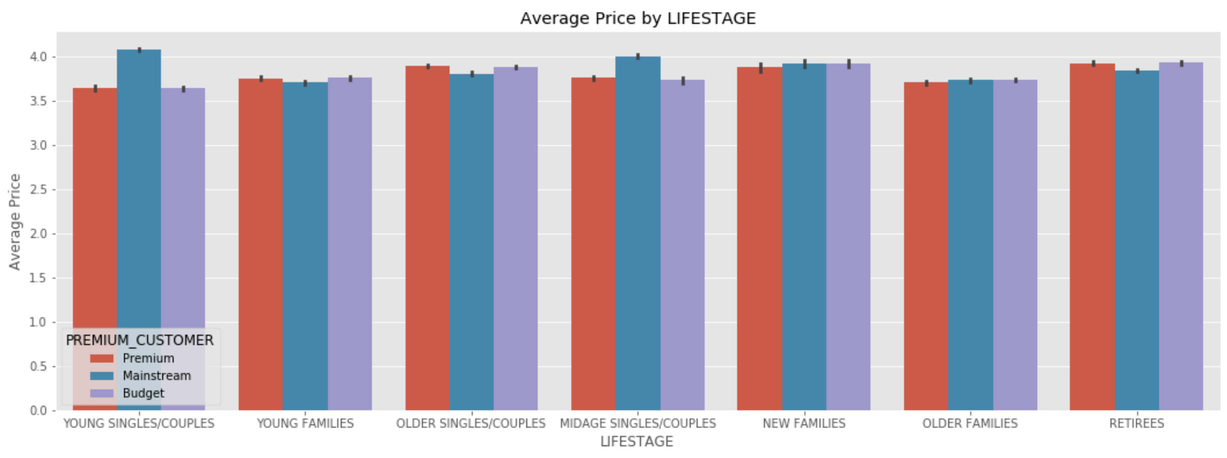


In [453]:
```
Avg_Price_per_Unit = Tot_by_customer['TOT_SALES']/Tot_by_customer['PROD_QTY']
Avg_Price_per_Unit.sort_values(ascending = False)
```

Out[453]:
```
LIFESTAGE               PREMIUM_CUSTOMER
YOUNG SINGLES/COUPLES   Mainstream          4.080079
MIDAGE SINGLES/COUPLES  Mainstream          4.000346
NEW FAMILIES            Mainstream          3.939315
                        Budget              3.936178
RETIREES                Budget              3.933660
                        Premium             3.924050
OLDER SINGLES/COUPLES   Premium             3.891695
NEW FAMILIES            Premium             3.886067
OLDER SINGLES/COUPLES   Budget              3.883299
RETIREES                Mainstream          3.842170
OLDER SINGLES/COUPLES   Mainstream          3.811578
MIDAGE SINGLES/COUPLES  Premium             3.763535
YOUNG FAMILIES          Budget              3.754840
                        Premium             3.750134
MIDAGE SINGLES/COUPLES  Budget              3.739975
OLDER FAMILIES          Budget              3.736009
                        Mainstream          3.726962
YOUNG FAMILIES          Mainstream          3.705029
OLDER FAMILIES          Premium             3.704855
YOUNG SINGLES/COUPLES   Premium             3.675060
                        Budget              3.667542
dtype: float64
```

In [454]:
```
plt.figure(figsize=(18,6))
avgPrice_lifestage = sns.barplot(x='LIFESTAGE', y = all_data['TOT_SALES']/all_dat

avgPrice_lifestage .set_xlabel('LIFESTAGE')
avgPrice_lifestage .set_ylabel('Average Price')
avgPrice_lifestage .set_title('Average Price by LIFESTAGE')
```

Out[454]:
```
Text(0.5, 1.0, 'Average Price by LIFESTAGE')
```



In [455]:
```
main = [Avg_Price_per_Unit['YOUNG SINGLES/COUPLES']['Mainstream'],Avg_Price_per_U
others = [Avg_Price_per_Unit['YOUNG SINGLES/COUPLES']['Budget'],Avg_Price_per_Uni
```

In [456]:
```
ttest_ind(main, others)
```

Out[456]:
```
Ttest_indResult(statistic=7.6068869237118735, pvalue=0.0016027797701074072)
```

In [473]:
```
# The t-test results in a p-value of 0.0016,
# the unit price for mainstream, young and mid-age singles and couples are signij
# that of budget or premium, young and midage singles and couples.
```

Implementing Apriori algorithm

In [518]:
```
#from apyori import apriori
#from mlxtend.frequent_patterns import apriori
#from mlxtend.frequent_patterns import association_rules
```

Uncover associations in Brand

In [522]:
```
df = all_data
df_young_main = df[(df['LIFESTAGE']=='YOUNG SINGLES/COUPLES') & (df['PREMIUM_CUST
df_young_main
```

Out[522]:

	LYLTY_CARD_NBR	LIFESTAGE	PREMIUM_CUSTOMER	DATE	STORE_NBR	TXN_ID
1	1002	YOUNG SINGLES/COUPLES	Mainstream	2018-09-16	1	2
9	1010	YOUNG SINGLES/COUPLES	Mainstream	2018-09-09	1	10
10	1010	YOUNG SINGLES/COUPLES	Mainstream	2018-12-14	1	1
21	1018	YOUNG SINGLES/COUPLES	Mainstream	2018-09-03	1	22
22	1018	YOUNG SINGLES/COUPLES	Mainstream	2018-11-28	1	23
...	...	...	...	...	...	..
264785	272391	YOUNG SINGLES/COUPLES	Mainstream	2018-12-07	272	27020
264805	2330041	YOUNG SINGLES/COUPLES	Mainstream	2018-09-23	77	23671
264818	2330321	YOUNG SINGLES/COUPLES	Mainstream	2018-07-30	77	23675
264824	2370181	YOUNG SINGLES/COUPLES	Mainstream	2018-08-02	88	24014
264833	2373711	YOUNG SINGLES/COUPLES	Mainstream	2018-12-14	88	24181

20854 rows × 14 columns

In [523]:
```
basket1 = df_young_main.pivot_table('PROD_QTY',['LYLTY_CARD_NBR'],'BRAND').fillna
```

In [524]:
```
def encode_units(x):
    if x <= 0:
        return 0
    if x >= 1:
        return 1

basket_sets_1 = basket1.applymap(encode_units)
basket_sets_1
```

Out[524]:

BRAND	BURGER	CCS	CHEETOS	CHEEZELS	COBS	DORITOS	FRENCH	GRNWVES
LYLTY_CARD_NBR								
1002	0	0	0	0	0	0	0	0
1010	0	0	0	0	0	1	0	0
1018	0	0	0	0	0	0	0	0
1020	0	0	0	0	0	0	0	1
1060	0	0	0	0	0	1	0	0
...	...	...	...	...	...	...	...	...
272391	0	0	0	0	0	0	0	0
2330041	0	0	0	0	0	0	0	1
2330321	0	0	0	0	0	0	0	0
2370181	0	0	0	0	0	0	0	0
2373711	0	0	0	0	0	0	0	0

8088 rows × 23 columns

In [525]:
```
frequent_itemsets_young = apriori(basket_sets_1, min_support=0.07, use_colnames=T
frequent_itemsets_young.sort_values('support', ascending = False).head()
```

Out[525]:

	support	itemsets
4	0.378956	(KETTLE)
1	0.267928	(DORITOS)
6	0.250742	(PRINGLES)
8	0.203759	(SMITHS)
3	0.140084	(INFUZIONS)

In [492]:
```
# The 'YOUNG SINGLES/COUPLES' & 'Mainstream' segment tend to favor the following
# - Kettle
# - Doritos
# - Pringles
# - Smiths
# - INFUZIONS
```

In [554]:
```
#rules_young = association_rules(frequent_itemsets_young, metric="lift", min_thre
#rules_young.head()
```

Out[554]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage
0	(Smiths)	(Doritos)	0.193744	0.238872	0.047725	0.246331	1.031222	0.001445
1	(Doritos)	(Smiths)	0.238872	0.193744	0.047725	0.199793	1.031222	0.001445

In [543]:
```
'''
Explanation of the output:

The output shows the support and confidence values for (B, A) and (A, B) as well.

A high lift value which means that it occurs more frequently than would be expect

'''
```

...

Uncover associations in Package Size

In [493]:
```
basket_2 = df_young_main.pivot_table('PROD_QTY',['LYLTY_CARD_NBR'],'PACK_SIZE').
```

In [494]:
```
def encode_units(x):
    if x <= 0:
        return 0
    if x >= 1:
        return 1

basket_sets_2 = basket_2.applymap(encode_units)
basket_sets_2
```

Out[494]:

PACK_SIZE	70	90	110	125	134	135	150	160	165	170	...	180	190	200	210	220
LYLTY_CARD_NBR																
1002	0	0	0	0	0	0	1	0	0	0	...	0	0	0	0	0
1010	0	0	0	0	0	0	0	0	0	1	...	0	0	0	0	0
1018	1	0	0	0	0	0	1	0	1	0	...	0	0	0	0	0
1020	0	0	0	0	0	0	1	0	0	0	...	1	0	0	0	0
1060	0	0	0	0	0	0	0	0	1	1	...	0	0	0	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
272391	0	0	0	0	0	1	0	0	0	0	...	0	0	0	0	0
2330041	0	0	0	0	0	0	0	0	0	0	...	0	0	0	1	0
2330321	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0
2370181	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0
2373711	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0

8088 rows × 21 columns

In [496]:
```
frequent_itemsets_2 = apriori(basket_sets_2, min_support=0.07, use_colnames=True
frequent_itemsets_2.sort_values('support', ascending = False).head()
```

Out[496]:

	support	itemsets
5	0.448566	(175)
2	0.318867	(150)
1	0.250742	(134)
0	0.219708	(110)
4	0.173096	(170)

In [ ]:
```
# The 'YOUNG SINGLES/COUPLES' & 'Mainstream' segment tend to favor the following
# - 175g
# - 150g
# - 134g
```

Conclusion

Sales have mainly generated through :

Budget - older families, Mainstream - young singles/couples, and Mainstream retirees shoppers.

We found a trends of :

- High spend in chips for mainstream young singles/couples and retirees, due to there being more of them than other buyers

- Mainstream, midage and young singles and couples are more likely to pay more per packet of chips

- The Mainstream young singles and couples are 38% more likely to purchase Kettle chips compared to the rest of the population

(The Category Manager may want to increase the category’s performance by off-locating some Kettle and smaller packs of chips

in discretionary space near segments where young singles and couples frequent more often to increase visibilty and impulse behaviour.)

In [ ]:
```
```