```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.style as style
import seaborn as sns
import datetime
%matplotlib inline

qvi_data=pd.read_csv("QVI_data.csv")    #   Reading the CSV file into
a pandas.DataFrame.
qvi_data
```

```
              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
...            ...        ...             ...     ...       ...
246735  2019-03-09        272          272319  270088        89
246736  2018-08-13        272          272358  270154        74
246737  2018-11-06        272          272379  270187        51
246738  2018-12-27        272          272379  270188        42
246739  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

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

246735   Kettle Sweet Chilli And Sour Cream 175g         2       10.8

246736             Tostitos Splash Of  Lime 175g         1        4.4

246737                   Doritos Mexicana    170g         2        8.8

246738   Doritos Corn Chip Mexican Jalapeno 150g         2        7.8

246739             Tostitos Splash Of  Lime 175g         2        8.8


        PACK_SIZE     BRAND               LIFESTAGE PREMIUM_CUSTOMER
```

```
0           175.0   Natural   YOUNG SINGLES/COUPLES          Premium
1           175.0       CCs  MIDAGE SINGLES/COUPLES           Budget
2           170.0    Smiths  MIDAGE SINGLES/COUPLES           Budget
3           175.0    Smiths  MIDAGE SINGLES/COUPLES           Budget
4           150.0    Kettle  MIDAGE SINGLES/COUPLES           Budget
...           ...       ...                     ...              ...
246735      175.0    Kettle   YOUNG SINGLES/COUPLES          Premium
246736      175.0  Tostitos   YOUNG SINGLES/COUPLES          Premium
246737      170.0   Doritos   YOUNG SINGLES/COUPLES          Premium
246738      150.0   Doritos   YOUNG SINGLES/COUPLES          Premium
246739      175.0  Tostitos   YOUNG SINGLES/COUPLES          Premium

[246740 rows x 12 columns]
```

```
qvi_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 246740 entries, 0 to 246739
Data columns (total 12 columns):
 #   Column            Non-Null Count   Dtype  
---  ------            --------------   -----  
 0   DATE              246740 non-null  object 
 1   STORE_NBR         246740 non-null  int64  
 2   LYLTY_CARD_NBR    246740 non-null  int64  
 3   TXN_ID            246740 non-null  int64  
 4   PROD_NBR          246740 non-null  int64  
 5   PROD_NAME         246740 non-null  object 
 6   PROD_QTY          246740 non-null  int64  
 7   TOT_SALES         246740 non-null  float64
 8   PACK_SIZE         240676 non-null  float64
 9   BRAND             246740 non-null  object 
 10  LIFESTAGE         246740 non-null  object 
 11  PREMIUM_CUSTOMER  246740 non-null  object 
dtypes: float64(2), int64(5), object(5)
memory usage: 22.6+ MB
```

```
qvi_data.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
PACK_SIZE         6064
BRAND                0
LIFESTAGE            0
```

```
PREMIUM_CUSTOMER       0
dtype: int64
```

```
qvi_data["YEAR_MONTH"]=pd.to_datetime(qvi_data["DATE"]).dt.to_period("M")   #   Storing the year and month of the recorded duration in a separate column.
qvi_data
```

```
              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
...            ...        ...             ...     ...       ...
246735  2019-03-09        272          272319  270088        89
246736  2018-08-13        272          272358  270154        74
246737  2018-11-06        272          272379  270187        51
246738  2018-12-27        272          272379  270188        42
246739  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

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

246735   Kettle Sweet Chilli And Sour Cream 175g         2       10.8

246736             Tostitos Splash Of  Lime 175g         1        4.4

246737                   Doritos Mexicana    170g         2        8.8

246738   Doritos Corn Chip Mexican Jalapeno 150g         2        7.8

246739             Tostitos Splash Of  Lime 175g         2        8.8


        PACK_SIZE     BRAND                LIFESTAGE
PREMIUM_CUSTOMER  \
0           175.0   Natural   YOUNG SINGLES/COUPLES          Premium

1           175.0       CCs  MIDAGE SINGLES/COUPLES           Budget
```

```
2           170.0    Smiths  MIDAGE SINGLES/COUPLES           Budget
3           175.0    Smiths  MIDAGE SINGLES/COUPLES           Budget
4           150.0    Kettle  MIDAGE SINGLES/COUPLES           Budget
...           ...       ...                     ...              ...
246735      175.0    Kettle   YOUNG SINGLES/COUPLES          Premium
246736      175.0  Tostitos   YOUNG SINGLES/COUPLES          Premium
246737      170.0   Doritos   YOUNG SINGLES/COUPLES          Premium
246738      150.0   Doritos   YOUNG SINGLES/COUPLES          Premium
246739      175.0  Tostitos   YOUNG SINGLES/COUPLES          Premium

       YEAR_MONTH
0         2018-10
1         2019-05
2         2019-05
3         2018-08
4         2018-08
...           ...
246735    2019-03
246736    2018-08
246737    2018-11
246738    2018-12
246739    2018-09

[246740 rows x 13 columns]
```

```
total_sales=qvi_data.groupby(["STORE_NBR", "YEAR_MONTH"])
["TOT_SALES"].sum()    #   Grouping the pandas.DataFrame by the
STORE_NBR and YEAR_MONTH column, and summing up the total sales for
them.
total_sales=total_sales.to_frame()  #   Converting the pandas.Series
to a pandas.DataFrame.
total_sales
```

```
                      TOT_SALES
STORE_NBR YEAR_MONTH
1         2018-07         188.9
          2018-08         168.4
          2018-09         268.1
          2018-10         175.4
          2018-11         184.8
...                         ...
```

```
272       2019-02          385.3
          2019-03          421.9
          2019-04          445.1
          2019-05          314.6
          2019-06          301.9

[3165 rows x 1 columns]
```

```
total_customers=qvi_data.groupby(["STORE_NBR", "YEAR_MONTH"])
["LYLTY_CARD_NBR"].nunique()   #   Grouping the pandas.DataFrame by
the STORE_NBR and YEAR_MONTH column, and counting the unique number of
customers for them.
total_customers=total_customers.to_frame()  #   Converting the
pandas.Series to a pandas.DataFrame.
total_customers
```

```
                      LYLTY_CARD_NBR
STORE_NBR YEAR_MONTH
1         2018-07                 47
          2018-08                 41
          2018-09                 57
          2018-10                 39
          2018-11                 44
...                              ...
272       2019-02                 44
          2019-03                 48
          2019-04                 54
          2019-05                 34
          2019-06                 33

[3165 rows x 1 columns]
```

```
transactions_per_customer=qvi_data.groupby(["STORE_NBR",
"YEAR_MONTH"])["TXN_ID"].nunique()/qvi_data.groupby(["STORE_NBR",
"YEAR_MONTH"])["LYLTY_CARD_NBR"].nunique()   #   Grouping the
pandas.DataFrame by the STORE_NBR and YEAR_MONTH column, and counting
the unique number of transactions per customer for them.
transactions_per_customer=transactions_per_customer.to_frame()  #
Converting the pandas.Series to a pandas.DataFrame.
transactions_per_customer
```

```
                                0
STORE_NBR YEAR_MONTH
1         2018-07        1.042553
          2018-08        1.000000
          2018-09        1.035088
          2018-10        1.025641
          2018-11        1.022727
...                           ...
272       2019-02        1.068182
```

```
          2019-03     1.062500
          2019-04     1.018519
          2019-05     1.176471
          2019-06     1.090909

[3165 rows x 1 columns]
```

```
dataframe_list=[total_sales, total_customers,
transactions_per_customer]    #   Creating a list of all the
pandas.DataFrames.
dataframe=pd.concat(dataframe_list, axis=1) #   Concatenating all the
pandas.DataFrames into one.
dataframe.columns=["TOT_SALES", "TOT_CUST", "TXN_PER_CUST"] #
Renaming the columns of the pandas.DataFrame.
dataframe
```

```
                      TOT_SALES  TOT_CUST  TXN_PER_CUST
STORE_NBR YEAR_MONTH
1         2018-07         188.9        47      1.042553
          2018-08         168.4        41      1.000000
          2018-09         268.1        57      1.035088
          2018-10         175.4        39      1.025641
          2018-11         184.8        44      1.022727
...                         ...       ...           ...
272       2019-02         385.3        44      1.068182
          2019-03         421.9        48      1.062500
          2019-04         445.1        54      1.018519
          2019-05         314.6        34      1.176471
          2019-06         301.9        33      1.090909

[3165 rows x 3 columns]
```

```
dataframe.isnull().sum()
```

```
TOT_SALES       0
TOT_CUST        0
TXN_PER_CUST    0
dtype: int64
```

```
recorded_stores=pd.pivot_table(qvi_data, index="STORE_NBR",
columns="YEAR_MONTH", values="TXN_ID", aggfunc="count") #   Pivoting
the pandas.DataFrame to get all the recorded transactions for each
store during the entire duration.
recorded_stores
```

```
YEAR_MONTH  2018-07  2018-08  2018-09  2018-10  2018-11  2018-12
2019-01  \
STORE_NBR

1              49.0     41.0     59.0     40.0     45.0     40.0
35.0
```

```
2               38.0     39.0     33.0     41.0     34.0     35.0
43.0
3              134.0    124.0    118.0    117.0    111.0    124.0
114.0
4              152.0    144.0    135.0    148.0    127.0    128.0
156.0
5              111.0     99.0    122.0     98.0    103.0    112.0
108.0
...              ...      ...      ...      ...      ...      ...
...
268             50.0     50.0     30.0     46.0     46.0     39.0
35.0
269            131.0    127.0    117.0    142.0    125.0    119.0
133.0
270            124.0    143.0    115.0    104.0    121.0    140.0
146.0
271            117.0     91.0    104.0    106.0    108.0    108.0
106.0
272             48.0     43.0     35.0     48.0     43.0     43.0
47.0

YEAR_MONTH  2019-02  2019-03  2019-04  2019-05  2019-06
STORE_NBR
1              51.0     47.0     40.0     48.0     40.0
2              31.0     41.0     45.0     47.0     38.0
3             134.0    126.0    102.0    113.0    117.0
4              97.0    127.0    130.0    112.0    129.0
5             103.0     86.0    101.0     94.0    117.0
...             ...      ...      ...      ...      ...
268            36.0     44.0     45.0     48.0     38.0
269           123.0    117.0    129.0    117.0    114.0
270           116.0    137.0    122.0    119.0    114.0
271            93.0     96.0     97.0    117.0    123.0
272            47.0     51.0     56.0     40.0     36.0

[271 rows x 12 columns]


recorded_stores.isnull().sum()

YEAR_MONTH
2018-07    7
2018-08    8
2018-09    7
2018-10    6
2018-11    7
2018-12    8
2019-01    8
2019-02    7
2019-03    6
```

```
2019-04    8
2019-05    8
2019-06    7
Freq: M, dtype: int64
```

```
unrecorded_stores=[]
for i in recorded_stores.index:
    if recorded_stores.loc[i].isnull().any():
        unrecorded_stores.append(i)
unrecorded_stores
```

```
[11, 31, 44, 76, 85, 92, 117, 177, 193, 206, 218, 252]
```

```
dataframe=dataframe.drop(unrecorded_stores, axis=0)
dataframe
```

```
                      TOT_SALES  TOT_CUST  TXN_PER_CUST
STORE_NBR YEAR_MONTH
1         2018-07         188.9        47      1.042553
          2018-08         168.4        41      1.000000
          2018-09         268.1        57      1.035088
          2018-10         175.4        39      1.025641
          2018-11         184.8        44      1.022727
...                         ...       ...           ...
272       2019-02         385.3        44      1.068182
          2019-03         421.9        48      1.062500
          2019-04         445.1        54      1.018519
          2019-05         314.6        34      1.176471
          2019-06         301.9        33      1.090909
```

```
[3108 rows x 3 columns]
```

```
pre_trial_data=dataframe.loc[dataframe.index.get_level_values("YEAR_MONTH")<"2019-02"]  #   Extracting the pandas.DataFrame for the pre-trial duration.
pre_trial_data=pre_trial_data.reset_index()
pre_trial_data
```

```
      STORE_NBR YEAR_MONTH  TOT_SALES  TOT_CUST  TXN_PER_CUST
0             1    2018-07      188.9        47      1.042553
1             1    2018-08      168.4        41      1.000000
2             1    2018-09      268.1        57      1.035088
3             1    2018-10      175.4        39      1.025641
4             1    2018-11      184.8        44      1.022727
...         ...        ...        ...       ...           ...
1808        272    2018-09      294.5        31      1.129032
1809        272    2018-10      405.1        41      1.146341
1810        272    2018-11      355.8        39      1.102564
1811        272    2018-12      363.1        43      1.000000
1812        272    2019-01      392.4        44      1.068182
```

```
[1813 rows x 5 columns]
```

```
control_stores=pre_trial_data[(pre_trial_data.STORE_NBR!=77 ) &
(pre_trial_data.STORE_NBR!=86) & (pre_trial_data.STORE_NBR!=88)]
[["TOT_SALES", "TOT_CUST",
"TXN_PER_CUST"]].groupby(pre_trial_data.STORE_NBR).sum()
control_stores
```

```
           TOT_SALES  TOT_CUST  TXN_PER_CUST
STORE_NBR
1            1295.90       300      7.207090
2            1046.60       248      7.393957
3            7184.45       718      8.156974
4            8576.20       811      8.483620
5            5313.90       605      8.703357
...              ...       ...           ...
268          1436.95       282      7.355784
269          6264.30       706      8.810135
270          6214.95       685      8.980519
271          5270.90       600      8.532508
272          2530.15       284      7.569960

[256 rows x 3 columns]
```

```
trial_stores=pre_trial_data[(pre_trial_data.STORE_NBR==77 ) |
(pre_trial_data.STORE_NBR==86) | (pre_trial_data.STORE_NBR==88)]
[["TOT_SALES", "TOT_CUST",
"TXN_PER_CUST"]].groupby(pre_trial_data.STORE_NBR).sum()
trial_stores
```

```
           TOT_SALES  TOT_CUST  TXN_PER_CUST
STORE_NBR
77           1595.50       282      7.392095
86           5795.65       668      8.672105
88           8832.80       848      8.404664
```

```
difference=control_stores.loc[control_stores.corrwith(trial_stores.loc
[77], method="pearson", axis=1).nlargest(5).index]    #   Getting the
pandas.DataFrame for the top five stores with the highest correlation
with the trial store.

#   Getting the difference between the trial store and the top five
stores with the highest correlation with the trial store.

difference=(trial_stores.loc[77]-
difference).sort_values(by="TOT_SALES", ascending=False)
difference["DIFFERENCE"]=difference["TOT_SALES"]-
difference["TOT_SALES"].mean()
difference.sort_values(by="DIFFERENCE", ascending=False)    #
Sorting the pandas.Dat
```

```
           TOT_SALES  TOT_CUST  TXN_PER_CUST  DIFFERENCE
STORE_NBR
159           1428.3     247.0      0.392095      892.46
158           1396.6     241.0     -0.107905      860.76
233             61.0       6.0      0.179662     -474.84
46             -13.3       4.0      0.125781     -549.14
50            -193.4     -36.0     -0.055257     -729.24
```

```
difference=control_stores.loc[control_stores.corrwith(trial_stores.loc
[86], axis=1).nlargest(5).index]  #   Getting the pandas.DataFrame for
the top five stores with the highest correlation with the trial store.

#   Getting the difference between the trial store and the top five
stores with the highest correlation with the trial store.

difference=(trial_stores.loc[86]-
difference).sort_values(by="TOT_SALES", ascending=False)
difference["DIFFERENCE"]=difference["TOT_SALES"]-
difference["TOT_SALES"].mean()
difference.sort_values(by="DIFFERENCE", ascending=False)    #
Sorting the pandas.Dat
```

```
           TOT_SALES  TOT_CUST  TXN_PER_CUST  DIFFERENCE
STORE_NBR
19            753.95      87.0      0.767476      641.61
70            358.25      41.0     -0.072382      245.91
105            66.55       7.0     -0.089492      -45.79
97              2.30       0.0     -0.084423     -110.04
133          -619.35     -70.0     -0.157577     -731.69
```

```
difference=control_stores.loc[control_stores.corrwith(trial_stores.loc
[86], axis=1).nlargest(5).index]  #   Getting the pandas.DataFrame for
the top five stores with the highest correlation with the trial store.

#   Getting the difference between the trial store and the top five
stores with the highest correlation with the trial store.

difference=(trial_stores.loc[86]-
difference).sort_values(by="TOT_SALES", ascending=False)
difference["DIFFERENCE"]=difference["TOT_SALES"]-
difference["TOT_SALES"].mean()
difference.sort_values(by="DIFFERENCE", ascending=False)    #
Sorting the pandas.DataFrame by the DIFFERENCE column.
```

```
           TOT_SALES  TOT_CUST  TXN_PER_CUST  DIFFERENCE
STORE_NBR
19            753.95      87.0      0.767476      641.61
70            358.25      41.0     -0.072382      245.91
105            66.55       7.0     -0.089492      -45.79
97              2.30       0.0     -0.084423     -110.04
133          -619.35     -70.0     -0.157577     -731.69
```

```
difference=control_stores.loc[control_stores.corrwith(trial_stores.loc
[88], axis=1).nlargest(5).index]  #   Getting the pandas.DataFrame for
the top five stores with the highest correlation with the trial store.

#   Getting the difference between the trial store and the top five
stores with the highest correlation with the trial store.

difference=(trial_stores.loc[88]-
difference).sort_values(by="TOT_SALES", ascending=False)
difference["DIFFERENCE"]=difference["TOT_SALES"]-
difference["TOT_SALES"].mean()
difference.sort_values(by="DIFFERENCE", ascending=False)    #
Sorting the pandas.DataFrame by the DIFFERENCE column.
```

STORE_NBR	TOT_SALES	TOT_CUST	TXN_PER_CUST	DIFFERENCE
60	1676.7	156.0	0.036661	781.18
75	1394.6	128.0	0.106366	499.08
72	956.9	86.0	0.105973	61.38
203	531.7	52.0	0.083568	-363.82
237	-82.3	-4.0	0.014843	-977.82

```
#   Extracting the pandas.DataFrames for each of the trial stores.

trial_stores_one=pre_trial_data.loc[pre_trial_data.STORE_NBR.isin([77]
)].reset_index()
trial_stores_two=pre_trial_data.loc[pre_trial_data.STORE_NBR.isin([86]
)].reset_index()
trial_stores_three=pre_trial_data.loc[pre_trial_data.STORE_NBR.isin([8
8])].reset_index()

#   Extracting the pandas.DataFrames for each of the control stores.

control_stores_one=pre_trial_data.loc[pre_trial_data.STORE_NBR.isin([4
6])].reset_index()
control_stores_two=pre_trial_data.loc[pre_trial_data.STORE_NBR.isin([5
7])].reset_index()
control_stores_three=pre_trial_data.loc[pre_trial_data.STORE_NBR.isin(
[165])].reset_index()

stores=pd.concat([trial_stores_one, trial_stores_two,
trial_stores_three, control_stores_one, control_stores_two,
control_stores_three], axis=0)    #   Concatenating all the
pandas.DataFrames into one.
stores
```

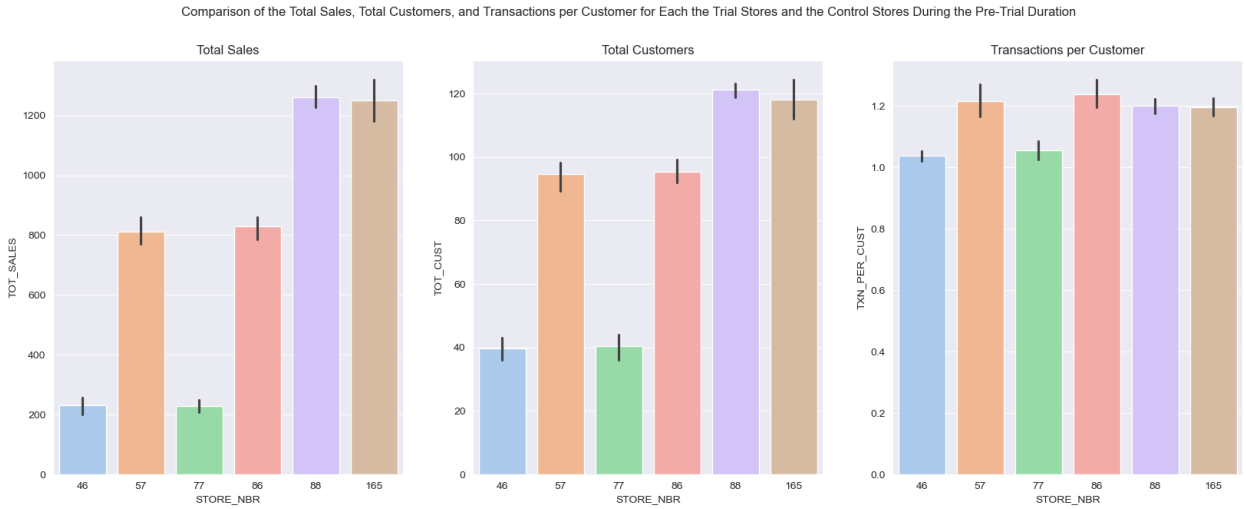
	index	STORE_NBR	YEAR_MONTH	TOT_SALES	TOT_CUST	TXN_PER_CUST
0	504	77	2018-07	268.40	47	1.085106
1	505	77	2018-08	247.50	46	1.000000
2	506	77	2018-09	216.80	40	1.050000
3	507	77	2018-10	194.30	36	1.027778

4	508	77	2018-11	224.90	39	1.076923
5	509	77	2018-12	255.20	43	1.023256
6	510	77	2019-01	188.40	31	1.129032
0	560	86	2018-07	851.00	94	1.276596
1	561	86	2018-08	726.85	92	1.130435
2	562	86	2018-09	855.00	100	1.200000
3	563	86	2018-10	898.80	105	1.238095
4	564	86	2018-11	851.20	95	1.242105
5	565	86	2018-12	812.20	93	1.236559
6	566	86	2019-01	800.60	89	1.348315
0	574	88	2018-07	1218.20	124	1.161290
1	575	88	2018-08	1242.20	125	1.200000
2	576	88	2018-09	1361.80	121	1.247934
3	577	88	2018-10	1270.80	120	1.225000
4	578	88	2018-11	1311.40	123	1.211382
5	579	88	2018-12	1213.00	120	1.141667
6	580	88	2019-01	1215.40	115	1.217391
0	294	46	2018-07	203.60	39	1.025641
1	295	46	2018-08	232.50	41	1.048780
2	296	46	2018-09	217.60	39	1.051282
3	297	46	2018-10	262.50	44	1.022727
4	298	46	2018-11	241.90	37	1.054054
5	299	46	2018-12	290.10	47	1.063830
6	300	46	2019-01	160.60	31	1.000000
0	371	57	2018-07	768.80	97	1.154639
1	372	57	2018-08	873.90	100	1.230000
2	373	57	2018-09	742.40	95	1.115789
3	374	57	2018-10	870.20	96	1.281250
4	375	57	2018-11	779.60	94	1.148936
5	376	57	2018-12	896.80	100	1.240000
6	377	57	2019-01	747.40	80	1.337500
0	1099	165	2018-07	1406.00	129	1.255814
1	1100	165	2018-08	1145.40	104	1.250000
2	1101	165	2018-09	1250.60	119	1.176471
3	1102	165	2018-10	1183.40	114	1.166667
4	1103	165	2018-11	1209.60	121	1.148760
5	1104	165	2018-12	1192.40	111	1.180180
6	1105	165	2019-01	1360.80	129	1.193798

```
#   Plotting the bar graphs for the total sales, total customers, and
transactions per customer for each of the trial stores and the control
stores.

sns.set_style("darkgrid")
figure, axis=plt.subplots(1, 3, figsize=(20, 7))
sns.barplot(x="STORE_NBR", y="TOT_SALES", data=stores, ax=axis[0],
palette="pastel")
axis[0].set_title("Total Sales")
sns.barplot(x="STORE_NBR", y="TOT_CUST", data=stores, ax=axis[1],
palette="pastel")
```

```
axis[1].set_title("Total Customers")
sns.barplot(x="STORE_NBR", y="TXN_PER_CUST", data=stores, ax=axis[2],
palette="pastel")
axis[2].set_title("Transactions per Customer")
figure.suptitle("Comparison of the Total Sales, Total Customers, and
Transactions per Customer for Each the Trial Stores and the Control
Stores During the Pre-Trial Duration")
plt.show()
```

```
C:\Users\hp\AppData\Local\Temp\ipykernel_8372\2559442622.py:5:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.barplot(x="STORE_NBR", y="TOT_SALES", data=stores, ax=axis[0],
palette="pastel")
C:\Users\hp\AppData\Local\Temp\ipykernel_8372\2559442622.py:7:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.barplot(x="STORE_NBR", y="TOT_CUST", data=stores, ax=axis[1],
palette="pastel")
C:\Users\hp\AppData\Local\Temp\ipykernel_8372\2559442622.py:9:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.barplot(x="STORE_NBR", y="TXN_PER_CUST", data=stores,
ax=axis[2], palette="pastel")
```




```
trial_data=dataframe.loc[dataframe.index.get_level_values("YEAR_MONTH"
)>="2019-02"]  #   Extracting the pandas.DataFrame for the trial
duration.
trial_data=trial_data.reset_index()
trial_data
```

	STORE_NBR	YEAR_MONTH	TOT_SALES	TOT_CUST	TXN_PER_CUST
0	1	2019-02	194.7	49	1.040816
1	1	2019-03	185.2	43	1.093023
2	1	2019-04	177.4	39	1.025641
3	1	2019-05	207.1	43	1.116279
4	1	2019-06	163.6	39	1.000000
...	...	...	...	...	...
1290	272	2019-02	385.3	44	1.068182
1291	272	2019-03	421.9	48	1.062500
1292	272	2019-04	445.1	54	1.018519
1293	272	2019-05	314.6	34	1.176471
1294	272	2019-06	301.9	33	1.090909

[1295 rows x 5 columns]

```
#   Extracting the pandas.DataFrames for each of the trial stores.

trial_stores_one=trial_data.loc[trial_data.STORE_NBR.isin([77])].reset
_index()
trial_stores_two=trial_data.loc[trial_data.STORE_NBR.isin([86])].reset
_index()
trial_stores_three=trial_data.loc[trial_data.STORE_NBR.isin([88])].res
et_index()

#   Extracting the pandas.DataFrames for each of the control stores.

control_stores_one=trial_data.loc[trial_data.STORE_NBR.isin([46])].res
et_index()
```

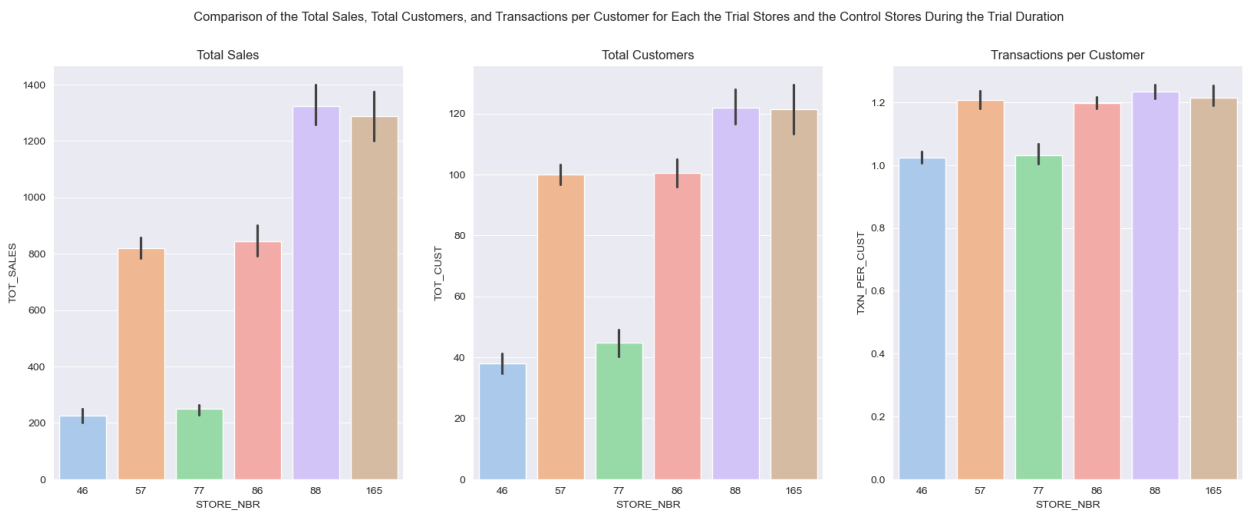
```
control_stores_two=trial_data.loc[trial_data.STORE_NBR.isin([57])].res
et_index()
control_stores_three=trial_data.loc[trial_data.STORE_NBR.isin([165])].
reset_index()

stores=pd.concat([trial_stores_one, trial_stores_two,
trial_stores_three, control_stores_one, control_stores_two,
control_stores_three], axis=0)    #   Concatenating all the
pandas.DataFrames into one.
stores
```

	index	STORE_NBR	YEAR_MONTH	TOT_SALES	TOT_CUST	TXN_PER_CUST
0	360	77	2019-02	211.60	40	1.000000
1	361	77	2019-03	255.10	46	1.108696
2	362	77	2019-04	258.10	47	1.000000
3	363	77	2019-05	272.30	53	1.018868
4	364	77	2019-06	246.60	38	1.026316
0	400	86	2019-02	872.80	105	1.238095
1	401	86	2019-03	945.40	108	1.175926
2	402	86	2019-04	804.00	99	1.202020
3	403	86	2019-05	826.90	99	1.181818
4	404	86	2019-06	766.00	92	1.184783
0	410	88	2019-02	1339.60	122	1.229508
1	411	88	2019-03	1467.00	133	1.263158
2	412	88	2019-04	1317.00	119	1.260504
3	413	88	2019-05	1236.85	123	1.195122
4	414	88	2019-06	1252.60	113	1.221239
0	210	46	2019-02	191.40	34	1.000000
1	211	46	2019-03	243.70	38	1.000000
2	212	46	2019-04	246.40	43	1.046512
3	213	46	2019-05	189.45	34	1.029412
4	214	46	2019-06	255.00	41	1.048780
0	265	57	2019-02	878.80	104	1.192308
1	266	57	2019-03	762.40	96	1.177083
2	267	57	2019-04	865.20	103	1.262136
3	268	57	2019-05	794.10	102	1.176471
4	269	57	2019-06	801.20	95	1.231579
0	785	165	2019-02	1176.30	111	1.198198
1	786	165	2019-03	1174.60	111	1.180180
2	787	165	2019-04	1299.90	123	1.219512
3	788	165	2019-05	1410.45	131	1.282443
4	789	165	2019-06	1378.90	131	1.198473

```
#   Plotting the bar graphs for the total sales, total customers, and
transactions per customer for each of the trial stores and the control
stores.

sns.set_style("darkgrid")
figure, axis=plt.subplots(1, 3, figsize=(20, 7))
sns.barplot(x="STORE_NBR", y="TOT_SALES", data=stores, ax=axis[0],
```

```
palette="pastel")
axis[0].set_title("Total Sales")
sns.barplot(x="STORE_NBR", y="TOT_CUST", data=stores, ax=axis[1],
palette="pastel")
axis[1].set_title("Total Customers")
sns.barplot(x="STORE_NBR", y="TXN_PER_CUST", data=stores, ax=axis[2],
palette="pastel")
axis[2].set_title("Transactions per Customer")
figure.suptitle("Comparison of the Total Sales, Total Customers, and
Transactions per Customer for Each the Trial Stores and the Control
Stores During the Trial Duration")
plt.show()
```

```
C:\Users\hp\AppData\Local\Temp\ipykernel_8372\3407102758.py:5:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.barplot(x="STORE_NBR", y="TOT_SALES", data=stores, ax=axis[0],
palette="pastel")
C:\Users\hp\AppData\Local\Temp\ipykernel_8372\3407102758.py:7:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.barplot(x="STORE_NBR", y="TOT_CUST", data=stores, ax=axis[1],
palette="pastel")
C:\Users\hp\AppData\Local\Temp\ipykernel_8372\3407102758.py:9:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.barplot(x="STORE_NBR", y="TXN_PER_CUST", data=stores,
ax=axis[2], palette="pastel")
```



While the other trial stores performed the same as their corresponding control stores, we can see, however, that STORE_NBR 88 slightly out-performed its control store, STORE_NBR 165, in all attributes.

STORE_NBR 86 and 88 show a significant difference in terms of the total sales, but this isn't the case with STORE_NBR 77, which may be because of the way the trial was implemented for it.

Due to the maximum difference in the total sales of all the trial stores, STORE_NBR 88 remains the best implementation of the trial.

The driver for the increase in total sales seems to be the purchasing customers rather than purchases per customer — the more the customers, the higher the sales.