```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

dataset = pd.read_csv('QVI_data.csv')

dataset.head()

   LYLTY_CARD_NBR        DATE  STORE_NBR  TXN_ID  PROD_NBR  \
0            1000  2018-10-17          1       1         5   
1            1002  2018-09-16          1       2        58   
2            1003  2019-03-07          1       3        52   
3            1003  2019-03-08          1       4       106   
4            1004  2018-11-02          1       5        96   

                                PROD_NAME  PROD_QTY  TOT_SALES  
PACK_SIZE  \
0  Natural Chip        Compny SeaSalt175g         2        6.0   
175   
1   Red Rock Deli Chikn&Garlic Aioli 150g         1        2.7   
150   
2   Grain Waves Sour    Cream&Chives 210G         1        3.6   
210   
3  Natural ChipCo      Hony Soy Chckn175g         1        3.0   
175   
4          WW Original Stacked Chips 160g         1        1.9   
160   

        BRAND              LIFESTAGE PREMIUM_CUSTOMER  
0     NATURAL  YOUNG SINGLES/COUPLES          Premium  
1         RRD  YOUNG SINGLES/COUPLES       Mainstream  
2     GRNWVES         YOUNG FAMILIES           Budget  
3     NATURAL         YOUNG FAMILIES           Budget  
4  WOOLWORTHS  OLDER SINGLES/COUPLES       Mainstream  
```

Lets Calculate Total_sales

```
total_sales = sum(dataset['TOT_SALES'])
total_sales

1933115.0
```

Total Number Of Customers

```
dataset.describe()

       LYLTY_CARD_NBR      STORE_NBR        TXN_ID       PROD_NBR  \
count    2.648340e+05  264834.000000  2.648340e+05  264834.000000   
mean     1.355488e+05     135.079423  1.351576e+05      56.583554   
std      8.057990e+04      76.784063  7.813292e+04      32.826444   
```

```
min      1.000000e+03       1.000000  1.000000e+00       1.000000
25%      7.002100e+04      70.000000  6.760050e+04      28.000000
50%      1.303570e+05     130.000000  1.351365e+05      56.000000
75%      2.030940e+05     203.000000  2.026998e+05      85.000000
max      2.373711e+06     272.000000  2.415841e+06     114.000000

            PROD_QTY      TOT_SALES      PACK_SIZE
count  264834.000000  264834.000000  264834.000000
mean        1.905813       7.299346     182.425512
std         0.343436       2.527241      64.325148
min         1.000000       1.500000      70.000000
25%         2.000000       5.400000     150.000000
50%         2.000000       7.400000     170.000000
75%         2.000000       9.200000     175.000000
max         5.000000      29.500000     380.000000
```

Average Number Of Transaction Per Customer

```
dataset.shape
```

```
(264834, 12)
```

```
total_customers = 241584
transaction = 264834
avg_transaction = total_customers/transaction
print(avg_transaction)
```

```
0.9122091574344684
```

Trail Store Performances

```
qvi = pd.read_csv('QVI_data.csv')
qvi.head()
```

```
   LYLTY_CARD_NBR        DATE  STORE_NBR  TXN_ID  PROD_NBR  \
0            1000  2018-10-17          1       1         5
1            1002  2018-09-16          1       2        58
2            1003  2019-03-07          1       3        52
3            1003  2019-03-08          1       4       106
4            1004  2018-11-02          1       5        96

                                PROD_NAME  PROD_QTY  TOT_SALES
PACK_SIZE  \
0  Natural Chip        Compny SeaSalt175g         2        6.0
175
1   Red Rock Deli Chikn&Garlic Aioli 150g         1        2.7
150
2   Grain Waves Sour    Cream&Chives 210G         1        3.6
210
```

```
3  Natural ChipCo      Hony Soy Chckn175g         1        3.0
175
4          WW Original Stacked Chips 160g         1        1.9
160

        BRAND              LIFESTAGE PREMIUM_CUSTOMER
0     NATURAL  YOUNG SINGLES/COUPLES          Premium
1         RRD  YOUNG SINGLES/COUPLES       Mainstream
2     GRNWVES         YOUNG FAMILIES           Budget
3     NATURAL         YOUNG FAMILIES           Budget
4  WOOLWORTHS  OLDER SINGLES/COUPLES       Mainstream
```

```
qvi.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 264834 entries, 0 to 264833
Data columns (total 12 columns):
 #   Column            Non-Null Count   Dtype  
---  ------            --------------   -----  
 0   LYLTY_CARD_NBR    264834 non-null  int64  
 1   DATE              264834 non-null  object 
 2   STORE_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
 8   PACK_SIZE         264834 non-null  int64  
 9   BRAND             264834 non-null  object 
 10  LIFESTAGE         264834 non-null  object 
 11  PREMIUM_CUSTOMER  264834 non-null  object 
dtypes: float64(1), int64(6), object(5)
memory usage: 24.2+ MB
```

```
qvi["DATE"] = pd.to_datetime(qvi["DATE"])
qvi["YEARMONTH"] = qvi["DATE"].dt.strftime("%Y%m").astype("int")

def monthly_store_metrics():
    store_yrmo_group = qvi.groupby(["STORE_NBR", "YEARMONTH"])
    total = store_yrmo_group["TOT_SALES"].sum()
    num_cust = store_yrmo_group["LYLTY_CARD_NBR"].nunique()
    trans_per_cust = store_yrmo_group.size() / num_cust
    avg_chips_per_cust = store_yrmo_group["PROD_QTY"].sum() / num_cust
    avg_chips_price = total / store_yrmo_group["PROD_QTY"].sum()
    aggregates = [total, num_cust, trans_per_cust, avg_chips_per_cust, 
avg_chips_price]
    metrics = pd.concat(aggregates, axis=1)
    metrics.columns = ["TOT_SALES", "nCustomers", "nTxnPerCust", 
"nChipsPerTxn", "avgPricePerUnit"]
    return metrics
```

```
qvi_monthly_metrics = monthly_store_metrics().reset_index()
qvi_monthly_metrics.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3169 entries, 0 to 3168
Data columns (total 7 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   STORE_NBR       3169 non-null   int64  
 1   YEARMONTH       3169 non-null   int32  
 2   TOT_SALES       3169 non-null   float64
 3   nCustomers      3169 non-null   int64  
 4   nTxnPerCust     3169 non-null   float64
 5   nChipsPerTxn    3169 non-null   float64
 6   avgPricePerUnit  3169 non-null   float64
dtypes: float64(4), int32(1), int64(2)
memory usage: 161.1 KB
```

```
#pre trial observation
#filter only stores with full 12 months observation
observ_counts = qvi_monthly_metrics["STORE_NBR"].value_counts()
full_observ_index = observ_counts[observ_counts == 12].index
full_observ = 
qvi_monthly_metrics[qvi_monthly_metrics["STORE_NBR"].isin(full_observ_
index)]
pretrial_full_observ = full_observ[full_observ["YEARMONTH"] < 201902]

pretrial_full_observ.head(8)
```

```
    STORE_NBR  YEARMONTH  TOT_SALES  nCustomers  nTxnPerCust 
nChipsPerTxn  \
0           1     201807      206.9          49     1.061224 
1.265306   
1           1     201808      176.1          42     1.023810 
1.285714   
2           1     201809      278.8          59     1.050847 
1.271186   
3           1     201810      188.1          44     1.022727 
1.318182   
4           1     201811      192.6          46     1.021739 
1.239130   
5           1     201812      189.6          42     1.119048 
1.357143   
6           1     201901      154.8          35     1.028571 
1.200000   
12          2     201807      150.8          39     1.051282 
1.179487   

    avgPricePerUnit  
0          3.337097  
```

```
1          3.261111
2          3.717333
3          3.243103
4          3.378947
5          3.326316
6          3.685714
12         3.278261
```

```python
def calcCorrTable(metricCol, storeComparison,
inputTable=pretrial_full_observ):
    """Calculate correlation for a measure, looping through each
control store.
    Args:
        metricCol (str): Name of column containing store's metric to
perform correlation test on.
        storeComparison (int): Trial store's number.
        inputTable (dataframe):  Metric table with potential
comparison stores.

    Returns:
        DataFrame: Monthly correlation table between Trial and each
Control stores.
    """
    control_store_nbrs = inputTable[~inputTable["STORE_NBR"].isin([77,
86, 88])]["STORE_NBR"].unique()
    corrs = pd.DataFrame(columns = ["YEARMONTH", "Trial_Str",
"Ctrl_Str", "Corr_Score"])
    trial_store = inputTable[inputTable["STORE_NBR"] ==
storeComparison][metricCol].reset_index()
    for control in control_store_nbrs:
        concat_df = pd.DataFrame(columns = ["YEARMONTH", "Trial_Str",
"Ctrl_Str", "Corr_Score"])
        control_store = inputTable[inputTable["STORE_NBR"] == control]
[metricCol].reset_index()
        concat_df["Corr_Score"] = trial_store.corrwith(control_store,
axis=1)
        concat_df["Trial_Str"] = storeComparison
        concat_df["Ctrl_Str"] = control
        concat_df["YEARMONTH"] =
list(inputTable[inputTable["STORE_NBR"] == storeComparison]
["YEARMONTH"])
        corrs = pd.concat([corrs, concat_df])
    return corrs

corr_table = pd.DataFrame()
for trial_num in [77, 86, 88]:
    corr_table = pd.concat([corr_table, calcCorrTable(["TOT_SALES",
"nCustomers","nTxnPerCust","nChipsPerTxn","avgPricePerUnit"],
trial_num)])
```

```python
corr_table.head(8)
```

```
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\2151722456.py:21: 
FutureWarning: The behavior of DataFrame concatenation with empty or 
all-NA entries is deprecated. In a future version, this will no longer 
exclude empty or all-NA columns when determining the result dtypes. To 
retain the old behavior, exclude the relevant entries before the 
concat operation.
  corrs = pd.concat([corrs, concat_df])
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\2151722456.py:21: 
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all-NA entries is deprecated. In a future version, this will no longer 
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  corrs = pd.concat([corrs, concat_df])
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\2151722456.py:21: 
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all-NA entries is deprecated. In a future version, this will no longer 
exclude empty or all-NA columns when determining the result dtypes. To 
retain the old behavior, exclude the relevant entries before the 
concat operation.
  corrs = pd.concat([corrs, concat_df])
```

```
  YEARMONTH Trial_Str Ctrl_Str  Corr_Score
0    201807        77        1    0.070414
1    201808        77        1    0.027276
2    201809        77        1    0.002389
3    201810        77        1   -0.020045
4    201811        77        1    0.030024
5    201812        77        1    0.063946
6    201901        77        1    0.001470
0    201807        77        2    0.142957
```

```python
def calculateMagnitudeDistance(metricCol, storeComparison, 
inputTable=pretrial_full_observ):
    """Calculate standardised magnitude distance for a measure, 
looping through each control store.
    Args:
        metricCol (str): Name of column containing store's metric to 
perform distance calculation on.
        storeComparison (int): Trial store's number.
        inputTable (dataframe):  Metric table with potential 
comparison stores.

    Returns:
        DataFrame: Monthly magnitude-distance table between Trial and 
each Control stores.
    """
    control_store_nbrs = inputTable[~inputTable["STORE_NBR"].isin([77,
86, 88])]["STORE_NBR"].unique()
    dists = pd.DataFrame()
    trial_store = inputTable[inputTable["STORE_NBR"] ==
storeComparison][metricCol]
    for control in control_store_nbrs:
        concat_df  = abs(inputTable[inputTable["STORE_NBR"] ==
storeComparison].reset_index()[metricCol] -
inputTable[inputTable["STORE_NBR"] == control].reset_index()
[metricCol])
        concat_df["YEARMONTH"] =
list(inputTable[inputTable["STORE_NBR"] == storeComparison]
["YEARMONTH"])
        concat_df["Trial_Str"] = storeComparison
        concat_df["Ctrl_Str"] = control
        dists = pd.concat([dists, concat_df])
    for col in metricCol:
        dists[col] = 1 - ((dists[col] - dists[col].min()) /
(dists[col].max() - dists[col].min()))
    dists["magnitude"] = dists[metricCol].mean(axis=1)
    return dists

dist_table = pd.DataFrame()
for trial_num in [77, 86, 88]:
    dist_table = pd.concat([dist_table,
calculateMagnitudeDistance(["TOT_SALES", "nCustomers", "nTxnPerCust",
"nChipsPerTxn", "avgPricePerUnit"], trial_num)])

dist_table.head(8)
dist_table
```

```
    TOT_SALES  nCustomers  nTxnPerCust  nChipsPerTxn  avgPricePerUnit
\
0    0.935431    0.980769     0.958035      0.739412         0.883569

1    0.942972    0.951923     0.993823      0.802894         0.886328

2    0.961503    0.836538     0.992126      0.730041         0.703027

3    0.988221    0.932692     0.989514      0.940460         0.590528

4    0.962149    0.951923     0.874566      0.730358         0.832481

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

2    0.207554    0.286822     0.462846      0.779879         0.923887

3    0.346797    0.387597     0.571497      0.796875         0.971133

4    0.286706    0.310078     0.623883      0.813241         0.966999
```

```
5    0.347151    0.387597     0.376456      0.699748          0.962198

6    0.402353    0.449612     0.450378      0.739714          0.971335
```

```
    YEARMONTH  Trial_Str  Ctrl_Str  magnitude
0      201807         77         1   0.899443
1      201808         77         1   0.915588
2      201809         77         1   0.844647
3      201810         77         1   0.888283
4      201811         77         1   0.870296
..        ...        ...       ...        ...
2      201809         88       272   0.532198
3      201810         88       272   0.614780
4      201811         88       272   0.600181
5      201812         88       272   0.554630
6      201901         88       272   0.602678

[5397 rows x 9 columns]
```

```
def combine_corr_dist(metricCol, storeComparison, 
inputTable=pretrial_full_observ):
    corrs = calcCorrTable(metricCol, storeComparison, inputTable)
    dists = calculateMagnitudeDistance(metricCol, storeComparison, 
inputTable)
    dists = dists.drop(metricCol, axis=1)
    combine = pd.merge(corrs, dists, on=["YEARMONTH", "Trial_Str", 
"Ctrl_Str"])
    return combine

compare_metrics_table1 = pd.DataFrame()
for trial_num in [77, 86, 88]:
    compare_metrics_table1 = pd.concat([compare_metrics_table1, 
combine_corr_dist(["TOT_SALES"], trial_num)])
```

```
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\2151722456.py:21: 
FutureWarning: The behavior of DataFrame concatenation with empty or 
all-NA entries is deprecated. In a future version, this will no longer 
exclude empty or all-NA columns when determining the result dtypes. To 
retain the old behavior, exclude the relevant entries before the 
concat operation.
  corrs = pd.concat([corrs, concat_df])
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\2151722456.py:21: 
FutureWarning: The behavior of DataFrame concatenation with empty or 
all-NA entries is deprecated. In a future version, this will no longer 
exclude empty or all-NA columns when determining the result dtypes. To 
retain the old behavior, exclude the relevant entries before the 
concat operation.
  corrs = pd.concat([corrs, concat_df])
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\2151722456.py:21:
```

```
FutureWarning: The behavior of DataFrame concatenation with empty or
all-NA entries is deprecated. In a future version, this will no longer
exclude empty or all-NA columns when determining the result dtypes. To
retain the old behavior, exclude the relevant entries before the
concat operation.
  corrs = pd.concat([corrs, concat_df])
```

```
corr_weight = 0.5
dist_weight = 1 - corr_weight

#Top 5 highest Composite Score for each Trial Store based on TOT_SALES
grouped_comparison_table1 =
compare_metrics_table1.groupby(["Trial_Str",
"Ctrl_Str"]).mean().reset_index()
grouped_comparison_table1["CompScore"] = (corr_weight *
grouped_comparison_table1["Corr_Score"]) + (dist_weight *
grouped_comparison_table1["magnitude"])
for trial_num in compare_metrics_table1["Trial_Str"].unique():

print(grouped_comparison_table1[grouped_comparison_table1["Trial_Str"]
== trial_num].sort_values(ascending=False, by="CompScore").head(), '\
n')
```

```
     Trial_Str  Ctrl_Str      YEARMONTH  Corr_Score  magnitude
CompScore
218         77       233  201822.571429         1.0   0.986477
0.993238
239         77       255  201822.571429         1.0   0.979479
0.989739
177         77       188  201822.571429         1.0   0.977663
0.988831
49          77        53  201822.571429         1.0   0.976678
0.988339
120         77       131  201822.571429         1.0   0.976267
0.988134

     Trial_Str  Ctrl_Str      YEARMONTH  Corr_Score  magnitude
CompScore
356         86       109  201822.571429         1.0   0.966783
0.983391
401         86       155  201822.571429         1.0   0.965876
0.982938
464         86       222  201822.571429         1.0   0.962280
0.981140
467         86       225  201822.571429         1.0   0.960512
0.980256
471         86       229  201822.571429         1.0   0.951704
0.975852

     Trial_Str  Ctrl_Str      YEARMONTH  Corr_Score  magnitude
```

```
CompScore
551         88        40  201822.571429         1.0   0.941165
0.970582
538         88        26  201822.571429         1.0   0.904377
0.952189
582         88        72  201822.571429         1.0   0.903800
0.951900
517         88         4  201822.571429         1.0   0.903466
0.951733
568         88        58  201822.571429         1.0   0.891678
0.945839
```

```
compare_metrics_table2 = pd.DataFrame()
for trial_num in [77, 86, 88]:
    compare_metrics_table2 = pd.concat([compare_metrics_table2,
combine_corr_dist(["nCustomers"], trial_num)])
```

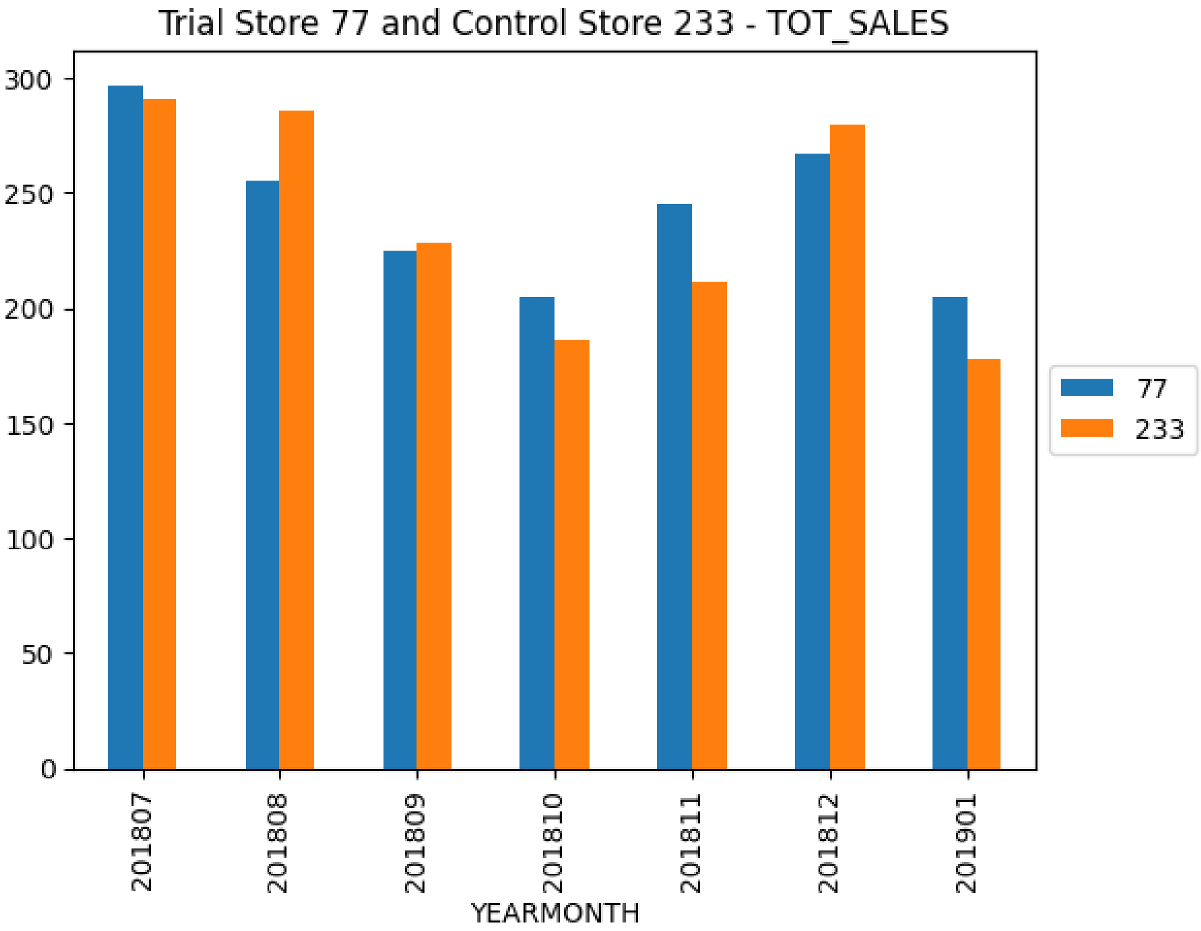
```
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\2151722456.py:21:
FutureWarning: The behavior of DataFrame concatenation with empty or
all-NA entries is deprecated. In a future version, this will no longer
exclude empty or all-NA columns when determining the result dtypes. To
retain the old behavior, exclude the relevant entries before the
concat operation.
  corrs = pd.concat([corrs, concat_df])
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\2151722456.py:21:
FutureWarning: The behavior of DataFrame concatenation with empty or
all-NA entries is deprecated. In a future version, this will no longer
exclude empty or all-NA columns when determining the result dtypes. To
retain the old behavior, exclude the relevant entries before the
concat operation.
  corrs = pd.concat([corrs, concat_df])
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\2151722456.py:21:
FutureWarning: The behavior of DataFrame concatenation with empty or
all-NA entries is deprecated. In a future version, this will no longer
exclude empty or all-NA columns when determining the result dtypes. To
retain the old behavior, exclude the relevant entries before the
concat operation.
  corrs = pd.concat([corrs, concat_df])
```

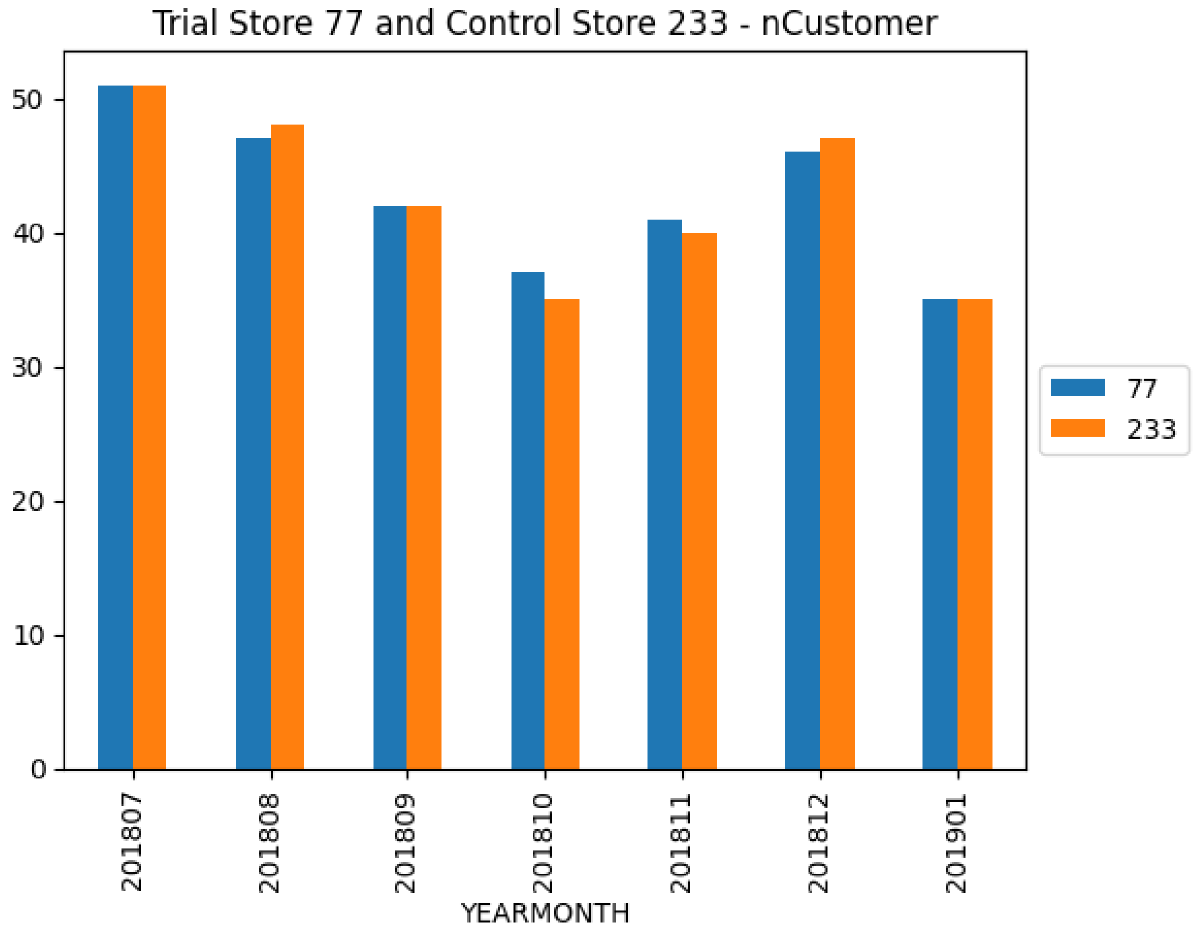
```
#Top 5 highest Composite Score for each Trial Store based on
nCustomers
grouped_comparison_table2 =
compare_metrics_table2.groupby(["Trial_Str",
"Ctrl_Str"]).mean().reset_index()
grouped_comparison_table2["CompScore"] = (corr_weight *
grouped_comparison_table2["Corr_Score"]) + (dist_weight *
grouped_comparison_table2["magnitude"])
for trial_num in compare_metrics_table2["Trial_Str"].unique():
```

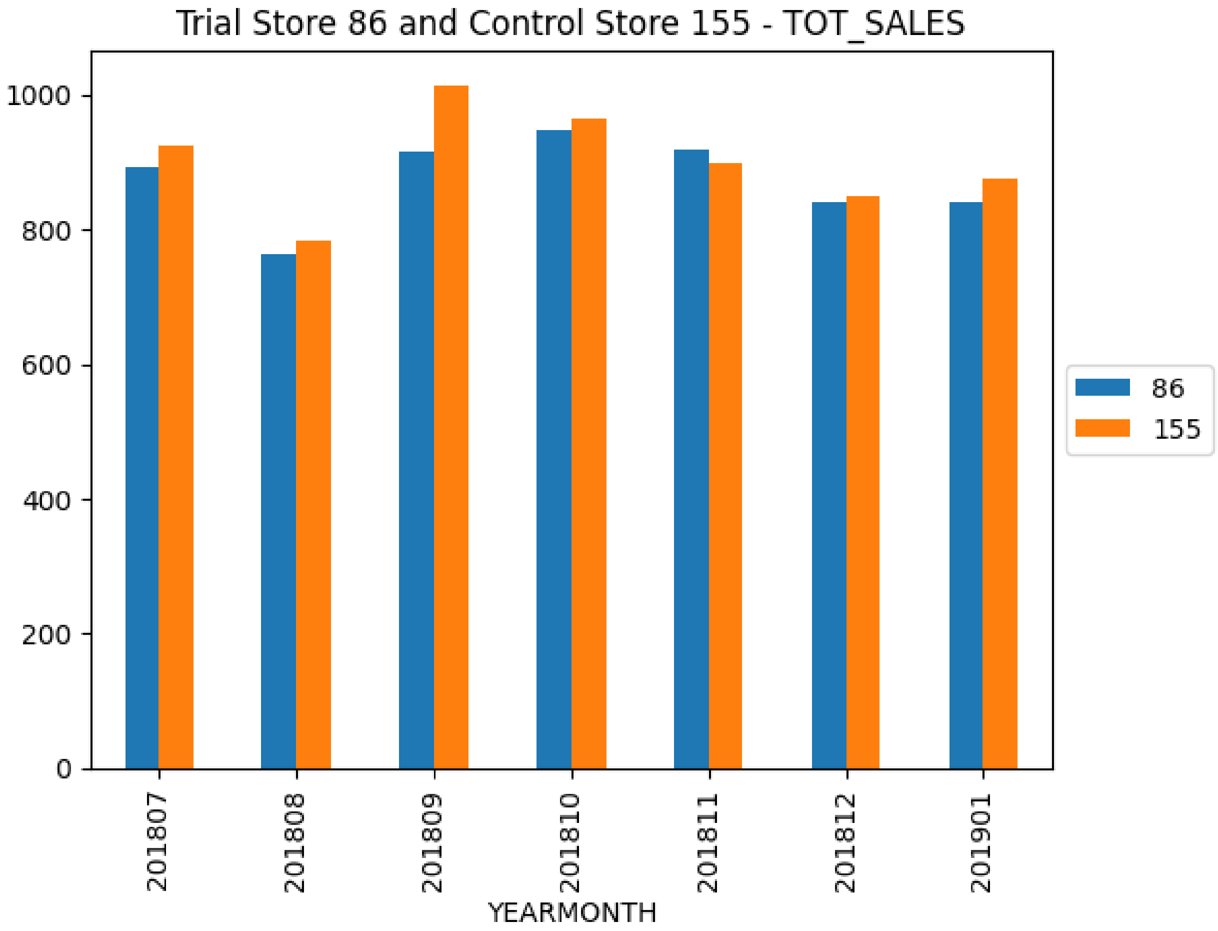
```
print(grouped_comparison_table2[grouped_comparison_table2["Trial_Str"]
== trial_num].sort_values(ascending=False, by="CompScore").head(), '\
n')

     Trial_Str  Ctrl_Str      YEARMONTH  Corr_Score  magnitude
CompScore
218         77       233  201822.571429         1.0   0.993132
0.996566
38          77        41  201822.571429         1.0   0.976648
0.988324
101         77       111  201822.571429         1.0   0.968407
0.984203
105         77       115  201822.571429         1.0   0.967033
0.983516
15          77        17  201822.571429         1.0   0.965659
0.982830

     Trial_Str  Ctrl_Str      YEARMONTH  Corr_Score  magnitude
CompScore
401         86       155  201822.571429         1.0   0.986772
0.993386
467         86       225  201822.571429         1.0   0.969577
0.984788
356         86       109  201822.571429         1.0   0.969577
0.984788
471         86       229  201822.571429         1.0   0.964286
0.982143
293         86        39  201822.571429         1.0   0.961640
0.980820

     Trial_Str  Ctrl_Str      YEARMONTH  Corr_Score  magnitude
CompScore
736         88       237  201822.571429         1.0   0.987818
0.993909
705         88       203  201822.571429         1.0   0.944629
0.972315
551         88        40  201822.571429         1.0   0.942414
0.971207
668         88       165  201822.571429         1.0   0.935770
0.967885
701         88       199  201822.571429         1.0   0.932447
0.966224


for trial_num in compare_metrics_table2["Trial_Str"].unique():
    a =
grouped_comparison_table1[grouped_comparison_table1["Trial_Str"] ==
trial_num].sort_values(ascending=False,
by="CompScore").set_index(["Trial_Str", "Ctrl_Str"])["CompScore"]
    b =
grouped_comparison_table2[grouped_comparison_table2["Trial_Str"] ==
trial_num].sort_values(ascending=False,
by="CompScore").set_index(["Trial_Str", "Ctrl_Str"])["CompScore"]
    print((pd.concat([a,b],
axis=1).sum(axis=1)/2).sort_values(ascending=False).head(3), '\n')
```

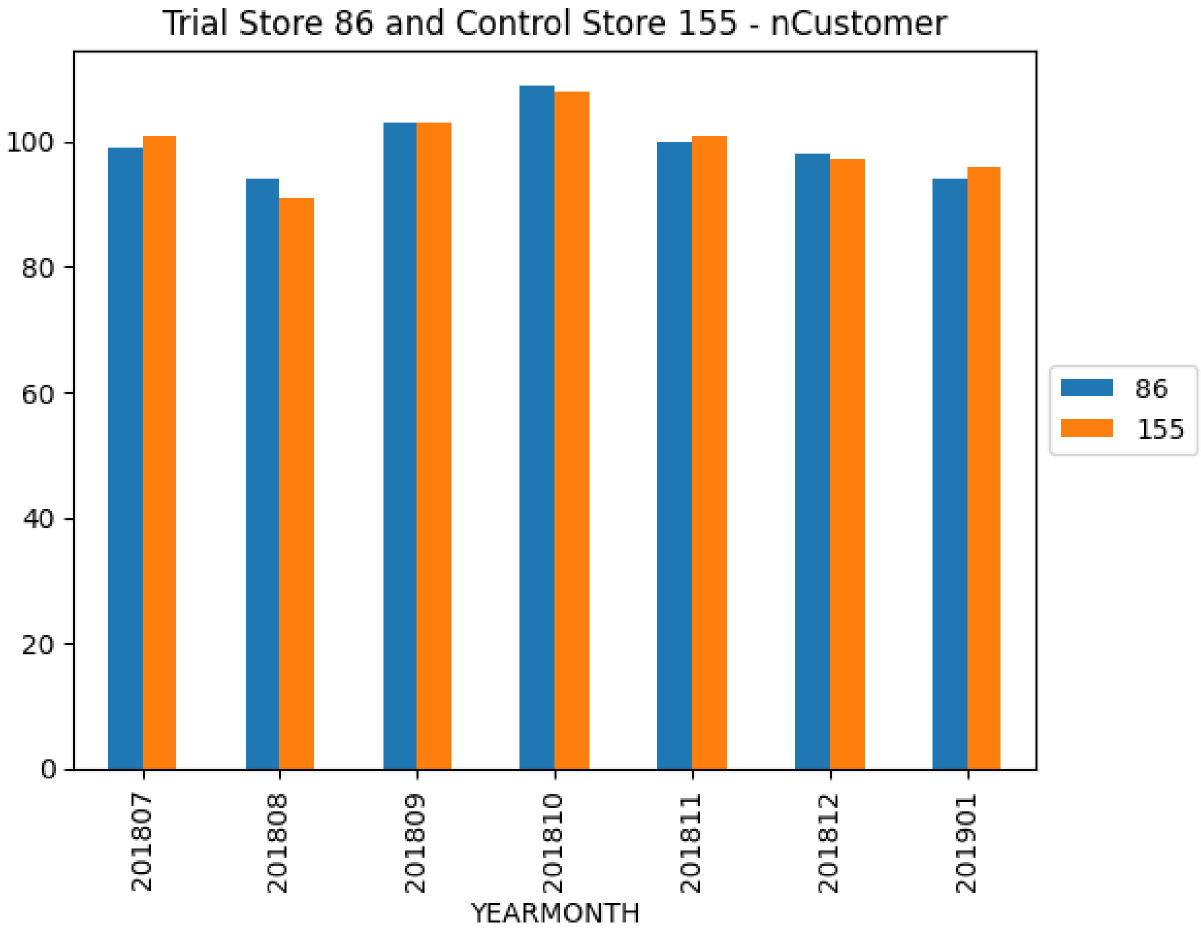
```
Trial_Str  Ctrl_Str
77         233          0.994902
           41           0.986020
           46           0.984762
dtype: float64

Trial_Str  Ctrl_Str
86         155          0.988162
           109          0.984090
           225          0.982522
dtype: float64

Trial_Str  Ctrl_Str
88         40           0.970895
           26           0.958929
           72           0.954079
dtype: float64
```

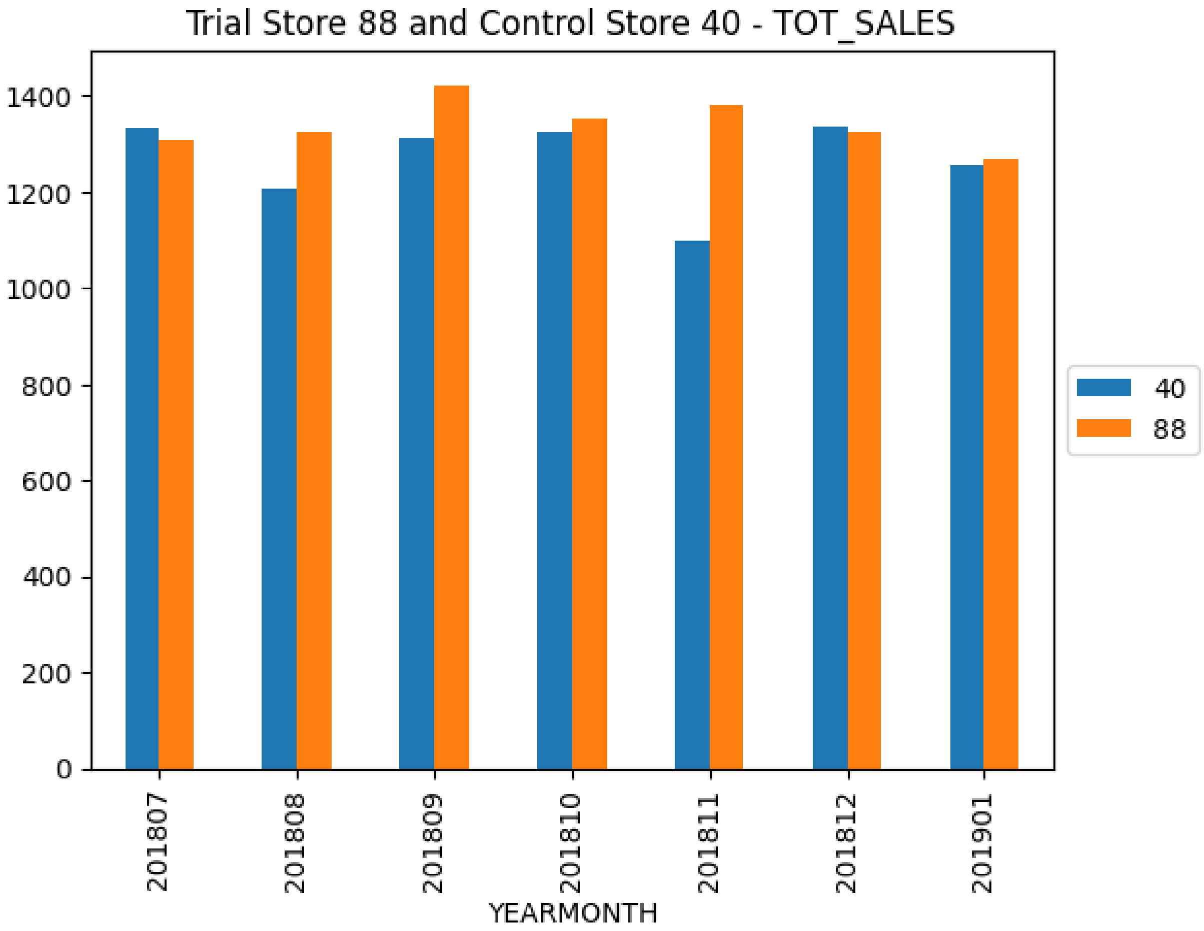
```
trial_control_dic = {77:233, 86:155, 88:40}
for key, val in trial_control_dic.items():
    pretrial_full_observ[pretrial_full_observ["STORE_NBR"].isin([key,
val])].groupby(
        ["YEARMONTH", "STORE_NBR"]).sum()
["TOT_SALES"].unstack().plot.bar()
    plt.legend(loc='center left', bbox_to_anchor=(1.0, 0.5))
    plt.title("Trial Store "+str(key)+" and Control Store "+str(val)+"
- TOT_SALES")
    plt.show()
    pretrial_full_observ[pretrial_full_observ["STORE_NBR"].isin([key,
val])].groupby(
    ["YEARMONTH", "STORE_NBR"]).sum()
["nCustomers"].unstack().plot.bar()
    plt.legend(loc='center left', bbox_to_anchor=(1.0, 0.5))
    plt.title("Trial Store "+str(key)+" and Control Store "+str(val)+"
- nCustomer")
    plt.show()
    print('\n')
```

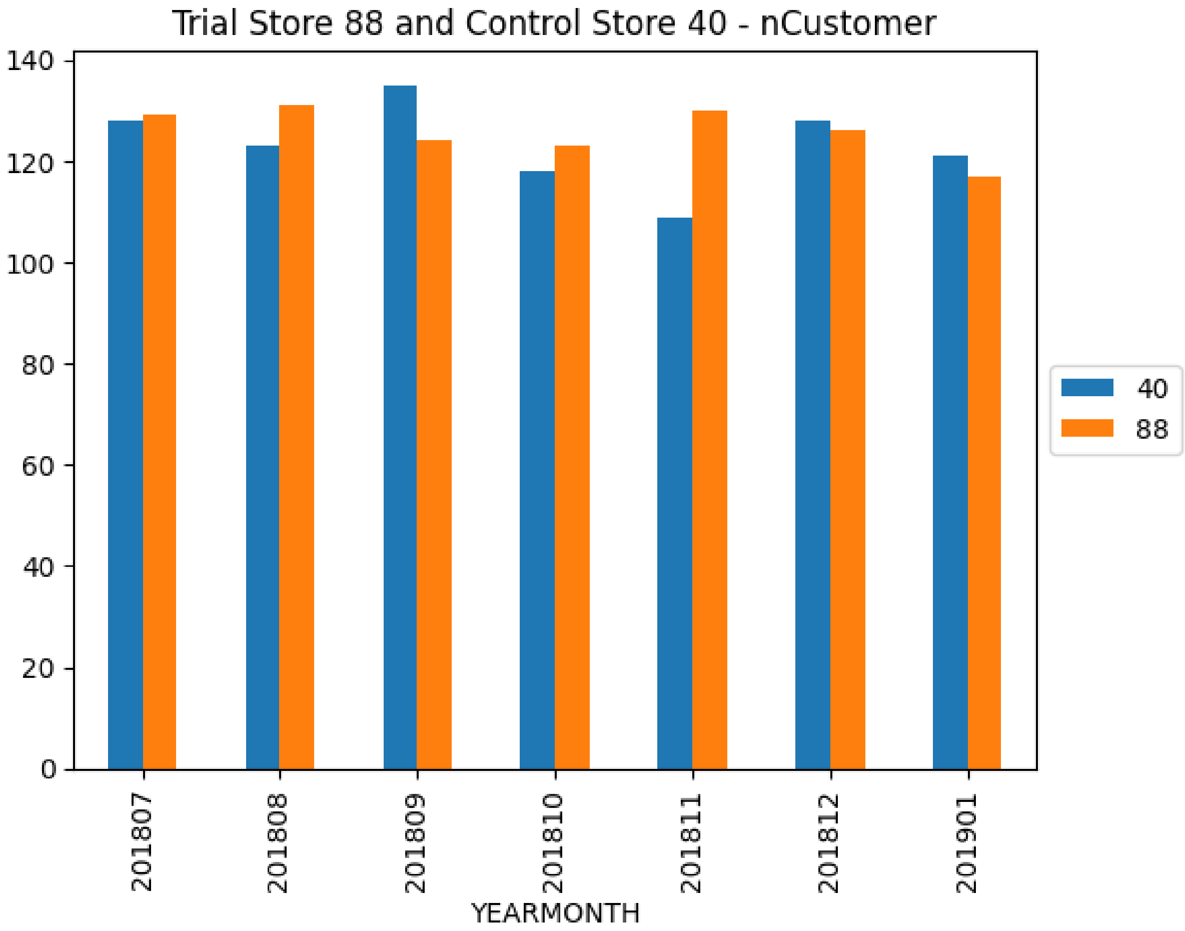

Trial Store 77 and Control Store 233 - TOT_SALES
300
250
200
150
100
50
0
201807
201808
201809
201810
201811
201812
201901
YEARMONTH
77
233


Trial Store 77 and Control Store 233 - nCustomer
0
10
20
30
40
50
201807
201808
201809
201810
201811
201812
201901
YEARMONTH
77
233


Trial Store 86 and Control Store 155 - TOT_SALES
0
200
400
600
800
1000
201807
201808
201809
201810
201811
201812
201901
YEARMONTH
86
155


Trial Store 86 and Control Store 155 - nCustomer
0
20
40
60
80
100
201807
201808
201809
201810
201811
201812
201901
YEARMONTH
86
155

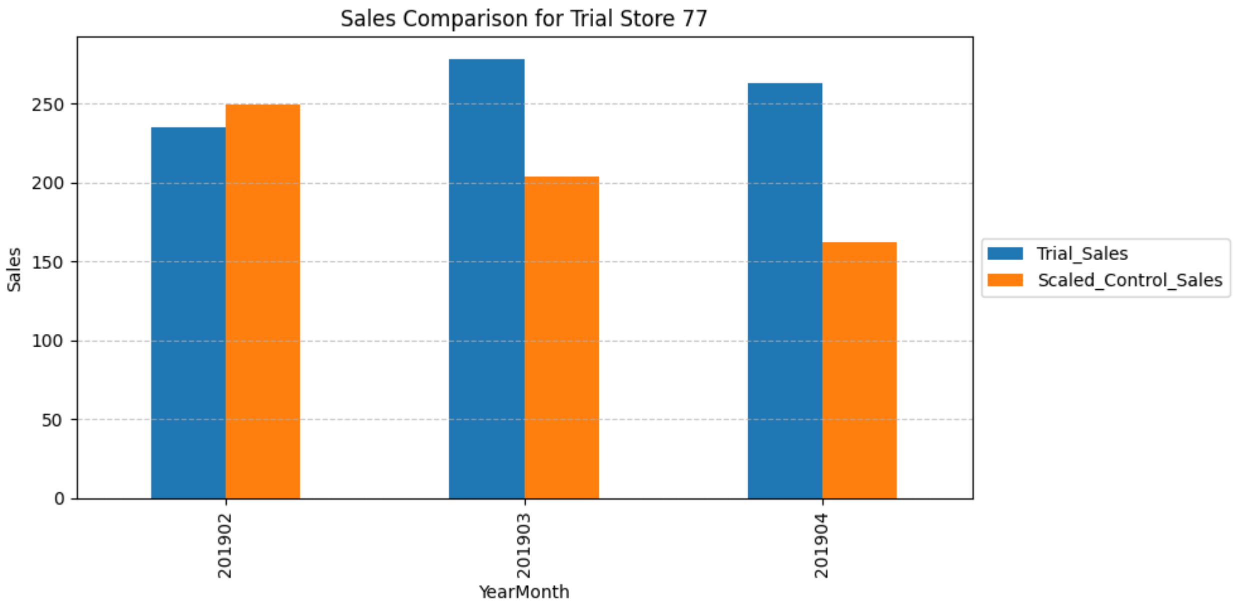

Trial Store 88 and Control Store 40 - TOT_SALES
1400
1200
1000
800
600
400
200
0
201807
201808
201809
201810
201811
201812
201901
YEARMONTH
40
88

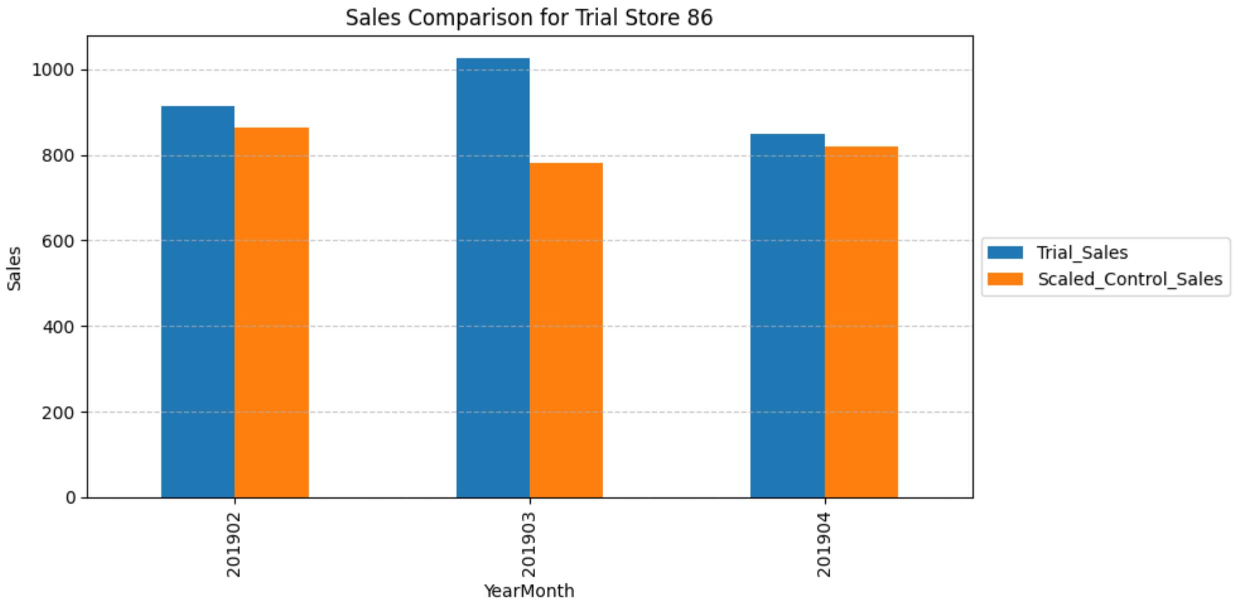


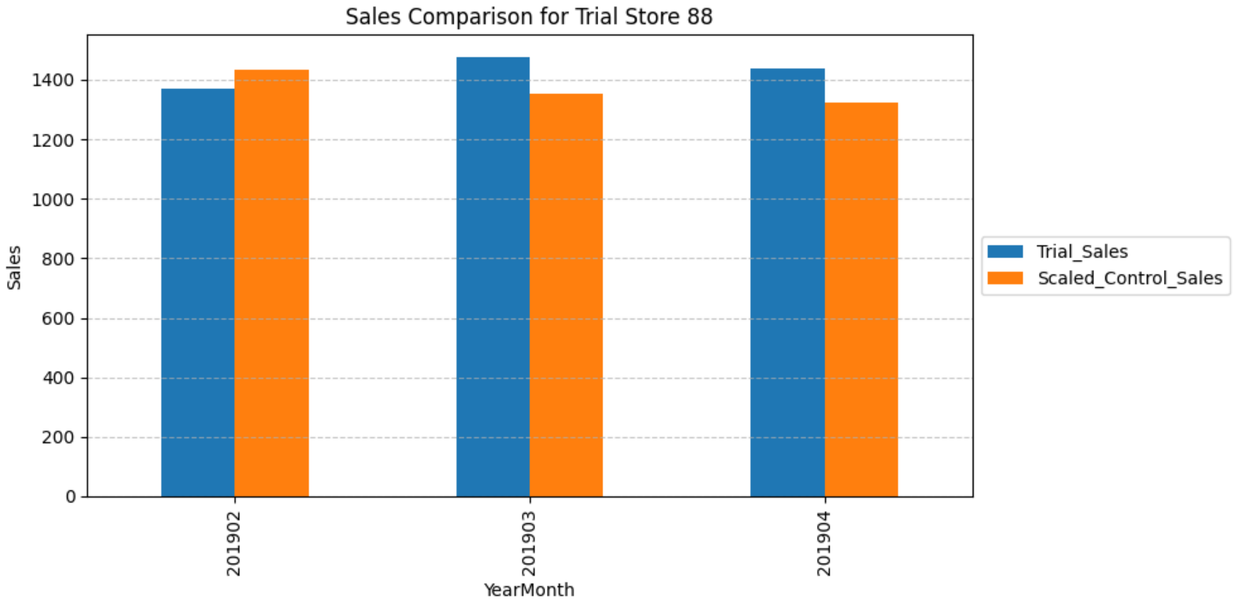
```
#Ratio of Store 77 and its Control store.
sales_ratio_77 =
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 77]
["TOT_SALES"].sum() /
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 233]
["TOT_SALES"].sum()

#Ratio of Store 86 and its Control store.
sales_ratio_86 =
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 86]
["TOT_SALES"].sum() /
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 155]
["TOT_SALES"].sum()

#Ratio of Store 77 and its Control store.
sales_ratio_88 =
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 88]
["TOT_SALES"].sum() /
```

```python
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 40]
["TOT_SALES"].sum()

trial_full_observ = full_observ[(full_observ["YEARMONTH"] >= 201902) &
(full_observ["YEARMONTH"] <= 201904)]
scaled_sales_control_stores =
full_observ[full_observ["STORE_NBR"].isin([233, 155, 40])]
[["STORE_NBR", "YEARMONTH", "TOT_SALES"]]

def scaler(row):
    if row["STORE_NBR"] == 233:
        return row["TOT_SALES"] * sales_ratio_77
    elif row["STORE_NBR"] == 155:
        return row["TOT_SALES"] * sales_ratio_86
    elif row["STORE_NBR"] == 40:
        return row["TOT_SALES"] * sales_ratio_88

scaled_sales_control_stores["ScaledSales"] =
scaled_sales_control_stores.apply(lambda row: scaler(row), axis=1)

# Filter trial period and pretrial period
trial_scaled_sales_control_stores = scaled_sales_control_stores[
    (scaled_sales_control_stores["YEARMONTH"] >= 201902) &
    (scaled_sales_control_stores["YEARMONTH"] <= 201904)
]

pretrial_scaled_sales_control_stores = scaled_sales_control_stores[
    scaled_sales_control_stores["YEARMONTH"] < 201902
]

# Create empty dictionary to store percentage differences
percentage_diff = {}

# Loop through each trial-control store pair
for trial, control in trial_control_dic.items():

    # Get control store sales during trial period
    a = trial_scaled_sales_control_stores[
        trial_scaled_sales_control_stores["STORE_NBR"] == control
    ]

    # Get trial store sales during trial period
    b = trial_full_observ[
        trial_full_observ["STORE_NBR"] == trial
    ][["STORE_NBR", "YEARMONTH", "TOT_SALES"]]

    # Calculate and store percentage difference
    percentage_diff[trial] = b["TOT_SALES"].sum() /
a["ScaledSales"].sum()
```

```
# Merge and plot the trial and control sales
merged = b[["YEARMONTH", "TOT_SALES"]].merge(
    a[["YEARMONTH", "ScaledSales"]],
    on="YEARMONTH"
).set_index("YEARMONTH").rename(
    columns={
        "ScaledSales": "Scaled_Control_Sales",
        "TOT_SALES": "Trial_Sales"
    }
)

# Bar Plot
ax = merged.plot.bar(figsize=(10,5))
plt.title(f"Sales Comparison for Trial Store {trial}")
plt.ylabel("Sales")
plt.xlabel("YearMonth")
plt.legend(loc='center left', bbox_to_anchor=(1.0, 0.5))
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```







```
percentage_diff
```

```
{77: 1.2615468650086281, 86: 1.1315014357363697, 88:
1.043458345854219}
```

```
#Creating a compiled percentage_difference table
temp1 = scaled_sales_control_stores.sort_values(by=["STORE_NBR",
"YEARMONTH"], ascending=[False,
True]).reset_index().drop(["TOT_SALES", "index"], axis=1)
temp2 = full_observ[full_observ["STORE_NBR"].isin([77,86,88])]
[["STORE_NBR", "YEARMONTH", "TOT_SALES"]].reset_index().drop(["index",
"YEARMONTH"], axis=1)
```

```
scaledsales_vs_trial = pd.concat([temp1, temp2], axis=1)
scaledsales_vs_trial.columns = ["c_STORE_NBR", "YEARMONTH",
"c_ScaledSales", "t_STORE_NBR", "t_TOT_SALES"]
scaledsales_vs_trial["Sales_Percentage_Diff"] =
(scaledsales_vs_trial["t_TOT_SALES"] -
scaledsales_vs_trial["c_ScaledSales"]) /
(((scaledsales_vs_trial["t_TOT_SALES"] +
scaledsales_vs_trial["c_ScaledSales"])/2))
def label_period(cell):
    if cell < 201902:
        return "pre"
    elif cell > 201904:
        return "post"
    else:
        return "trial"
scaledsales_vs_trial["trial_period"] =
scaledsales_vs_trial["YEARMONTH"].apply(lambda cell:
label_period(cell))
scaledsales_vs_trial[scaledsales_vs_trial["trial_period"] == "trial"]
```

```
    c_STORE_NBR  YEARMONTH  c_ScaledSales  t_STORE_NBR  t_TOT_SALES  \
7           233     201902     249.762622           77        235.0
8           233     201903     203.802205           77        278.5
9           233     201904     162.345704           77        263.5
19          155     201902     864.522060           86        913.2
20          155     201903     780.320405           86       1026.8
21          155     201904     819.317024           86        848.2
31           40     201902    1434.399269           88       1370.2
32           40     201903    1352.064709           88       1477.2
33           40     201904    1321.797762           88       1439.4

    Sales_Percentage_Diff trial_period
7               -0.060907        trial
8                0.309755        trial
9                0.475075        trial
19               0.054764        trial
20               0.272787        trial
21               0.034642        trial
31              -0.045781        trial
32               0.088458        trial
33               0.085182        trial
```

```
from scipy.stats import ttest_ind, t

# Step 1
for num in [40, 155, 233]:
    print("Store", num)

print(ttest_ind(pretrial_scaled_sales_control_stores[pretrial_scaled_s
ales_control_stores["STORE_NBR"] == num]["ScaledSales"],
trial_scaled_sales_control_stores[trial_scaled_sales_control_stores["S
TORE_NBR"] == num]["ScaledSales"],
                   equal_var=False), '\n')

#print(len(pretrial_scaled_sales_control_stores[pretrial_scaled_sales_
control_stores["STORE_NBR"] == num]["ScaledSales"]),
len(trial_scaled_sales_control_stores[trial_scaled_sales_control_store
s["STORE_NBR"] == num]["ScaledSales"]))

alpha = 0.05
print("Critical t-value for 95% confidence interval:")
print(t.ppf((alpha/2, 1-alpha/2),
df=min([len(pretrial_scaled_sales_control_stores[pretrial_scaled_sales
_control_stores["STORE_NBR"] == num]),

len(trial_scaled_sales_control_stores[trial_scaled_sales_control_store
s["STORE_NBR"] == num])])-1))

Store 40
TtestResult(statistic=-0.5958372343168558, pvalue=0.5722861621434027,
df=6.228548324256264)

Store 155
TtestResult(statistic=1.4291956879290917, pvalue=0.1972705865160342,
df=6.794437403919926)

Store 233
TtestResult(statistic=1.191102601097452, pvalue=0.2944500606486209,
df=4.355475642590669)

Critical t-value for 95% confidence interval:
[-4.30265273  4.30265273]

a =
pretrial_scaled_sales_control_stores[pretrial_scaled_sales_control_sto
res["STORE_NBR"] == 40]["ScaledSales"],
b =
trial_scaled_sales_control_stores[trial_scaled_sales_control_stores["S
TORE_NBR"] == 40]["ScaledSales"]

# Step 2
for trial, cont in trial_control_dic.items():
    print("Trial store:", trial, ", Control store:", cont)

print(ttest_ind(pretrial_full_observ[pretrial_full_observ["STORE_NBR"]
== trial]["TOT_SALES"],

pretrial_scaled_sales_control_stores[pretrial_scaled_sales_control_sto
res["STORE_NBR"] == cont]["ScaledSales"],
                   equal_var=True), '\n')
    #print(len(pretrial_full_observ[pretrial_full_observ["STORE_NBR"]
== trial]
["TOT_SALES"]),len(pretrial_scaled_sales_control_stores[pretrial_scale
d_sales_control_stores["STORE_NBR"] == cont]["ScaledSales"]))

alpha = 0.05
print("Critical t-value for 95% confidence interval:")
print(t.ppf((alpha/2, 1-alpha/2),
df=len(pretrial_full_observ[pretrial_full_observ["STORE_NBR"] ==
trial])-1))
```

```
Trial store: 77 , Control store: 233
TtestResult(statistic=-1.2533353315065932e-15,
pvalue=0.999999999999999, df=12.0)

Trial store: 86 , Control store: 155
TtestResult(statistic=3.1048311203382156e-15,
pvalue=0.9999999999999976, df=12.0)

Trial store: 88 , Control store: 40
TtestResult(statistic=-5.69358613974361e-15,
pvalue=0.9999999999999956, df=12.0)

Critical t-value for 95% confidence interval:
[-2.44691185  2.44691185]
```

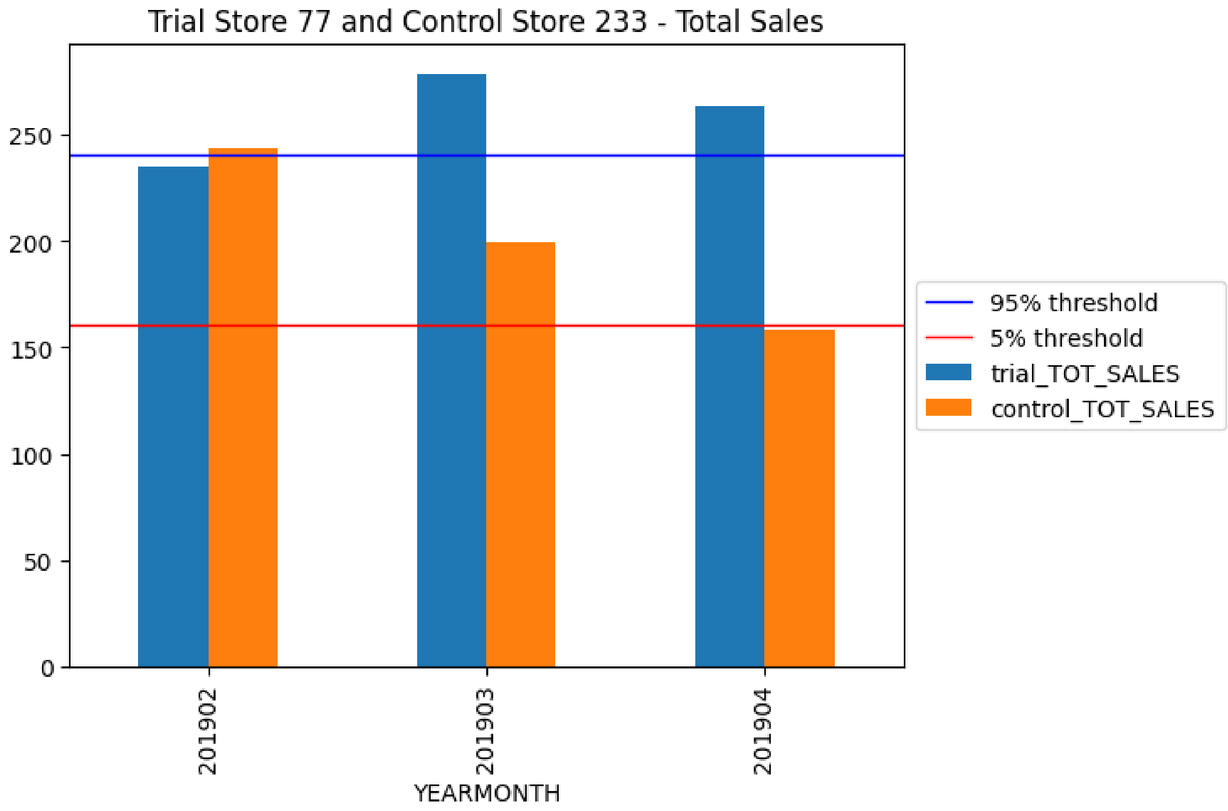
```
# Step 3
for trial, cont in trial_control_dic.items():
    print("Trial store:", trial, ", Control store:", cont)
    temp_pre =
scaledsales_vs_trial[(scaledsales_vs_trial["c_STORE_NBR"] == cont) &
(scaledsales_vs_trial["trial_period"]=="pre")]
    std = temp_pre["Sales_Percentage_Diff"].std()
    mean = temp_pre["Sales_Percentage_Diff"].mean()
    #print(std, mean)
    for t_month in
scaledsales_vs_trial[scaledsales_vs_trial["trial_period"] == "trial"]
["YEARMONTH"].unique():
        pdif = scaledsales_vs_trial[(scaledsales_vs_trial["YEARMONTH"]
== t_month) & (scaledsales_vs_trial["t_STORE_NBR"] == trial)]
["Sales_Percentage_Diff"]
        print(t_month,":",(float(pdif)-mean)/std)
    print('\n')

print("Critical t-value for 95% confidence interval:")
conf_intv_95 = t.ppf(0.95, df=len(temp_pre)-1)
print(conf_intv_95)
```

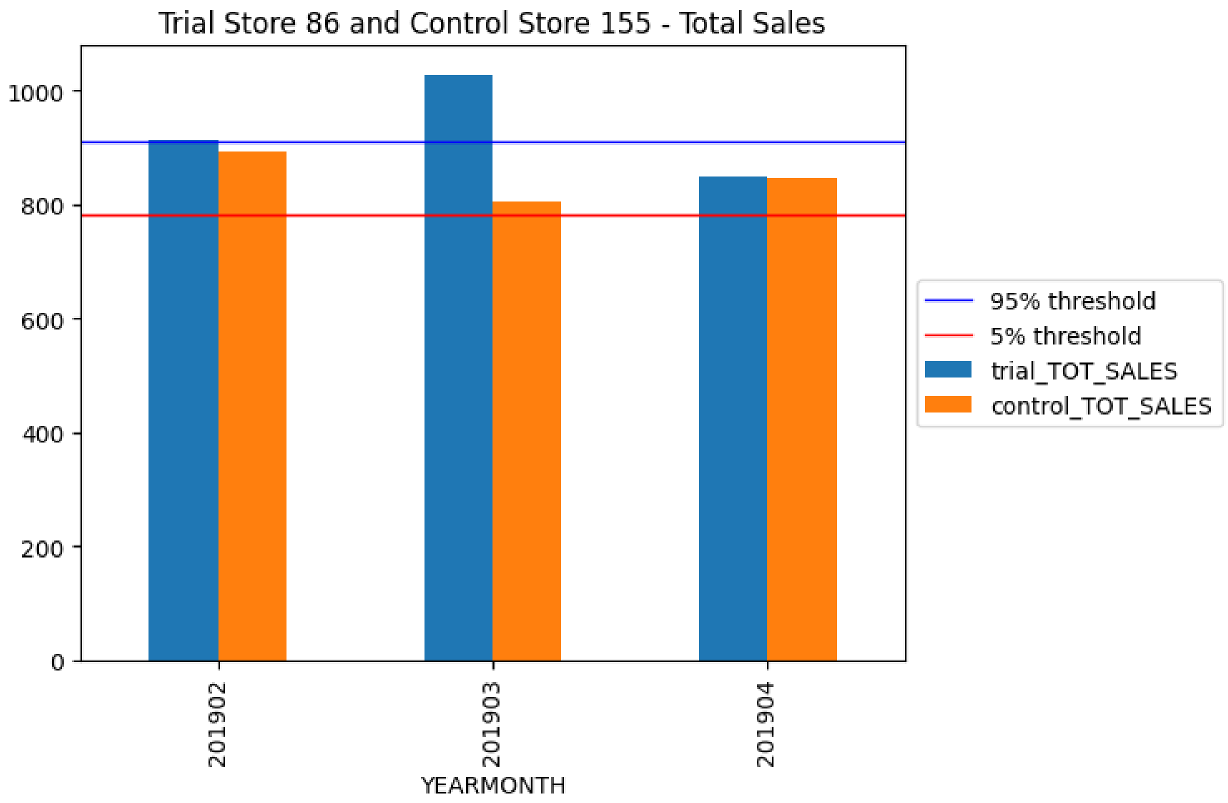
```
Trial store: 77 , Control store: 233
201902 : -0.7171038288055838
201903 : 3.035317928855674
201904 : 4.708944418758219


Trial store: 86 , Control store: 155
201902 : 1.4133618775921597
201903 : 7.123063846042147
201904 : 0.8863824572944234


Trial store: 88 , Control store: 40
201902 : -0.5481633746817577
201903 : 1.0089992743637823
201904 : 0.9710006270463672


Critical t-value for 95% confidence interval:
1.9431802805153018
```

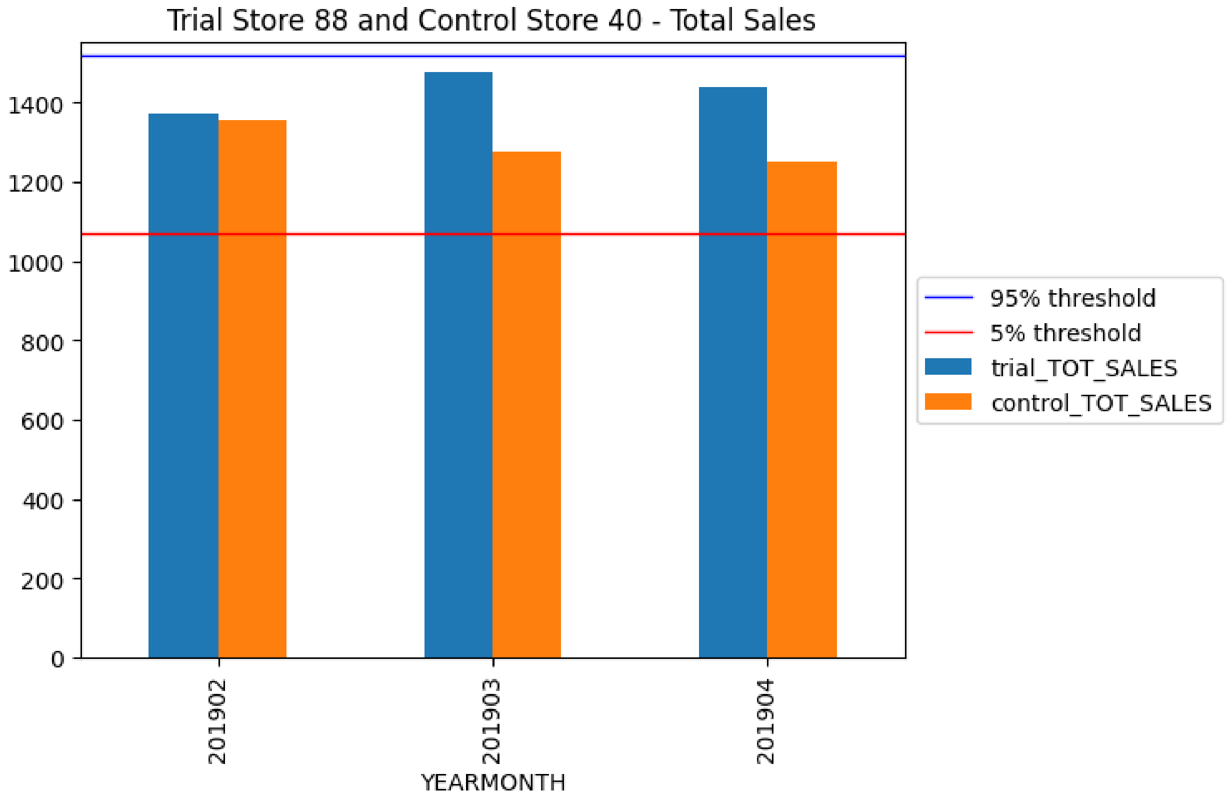
```
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\1265862777.py:10:
FutureWarning: Calling float on a single element Series is deprecated
and will raise a TypeError in the future. Use float(ser.iloc[0])
instead
  print(t_month,":",(float(pdif)-mean)/std)
```

```python
for trial, control in trial_control_dic.items():
    a =
trial_scaled_sales_control_stores[trial_scaled_sales_control_stores["S
TORE_NBR"] == control].rename(columns={"TOT_SALES":
"control_TOT_SALES"})
    b = trial_full_observ[trial_full_observ["STORE_NBR"] == trial]
[["STORE_NBR", "YEARMONTH", "TOT_SALES"]].rename(columns={"TOT_SALES":
"trial_TOT_SALES"})
    comb = b[["YEARMONTH", "trial_TOT_SALES"]].merge(a[["YEARMONTH",
"control_TOT_SALES"]],on="YEARMONTH").set_index("YEARMONTH")
    comb.plot.bar()
    cont_sc_sales =
trial_scaled_sales_control_stores[trial_scaled_sales_control_stores["S
TORE_NBR"] == control]["TOT_SALES"]
    std = scaledsales_vs_trial[(scaledsales_vs_trial["c_STORE_NBR"] ==
control) & (scaledsales_vs_trial["trial_period"]=="pre")]
["Sales_Percentage_Diff"].std()
    thresh95 = cont_sc_sales.mean() + (cont_sc_sales.mean() * std * 2)
    thresh5 = cont_sc_sales.mean() - (cont_sc_sales.mean() * std * 2)
    plt.axhline(y=thresh95,linewidth=1, color='b', label="95%
threshold")
    plt.axhline(y=thresh5,linewidth=1, color='r', label="5%
threshold")
```

```
    plt.legend(loc='center left', bbox_to_anchor=(1.0, 0.5))
    plt.title("Trial Store "+str(trial)+" and Control Store 
"+str(control)+" - Total Sales")
    plt.savefig("TS {} and CS {} - 
TOT_SALES.png".format(trial,control), bbox_inches="tight")
```

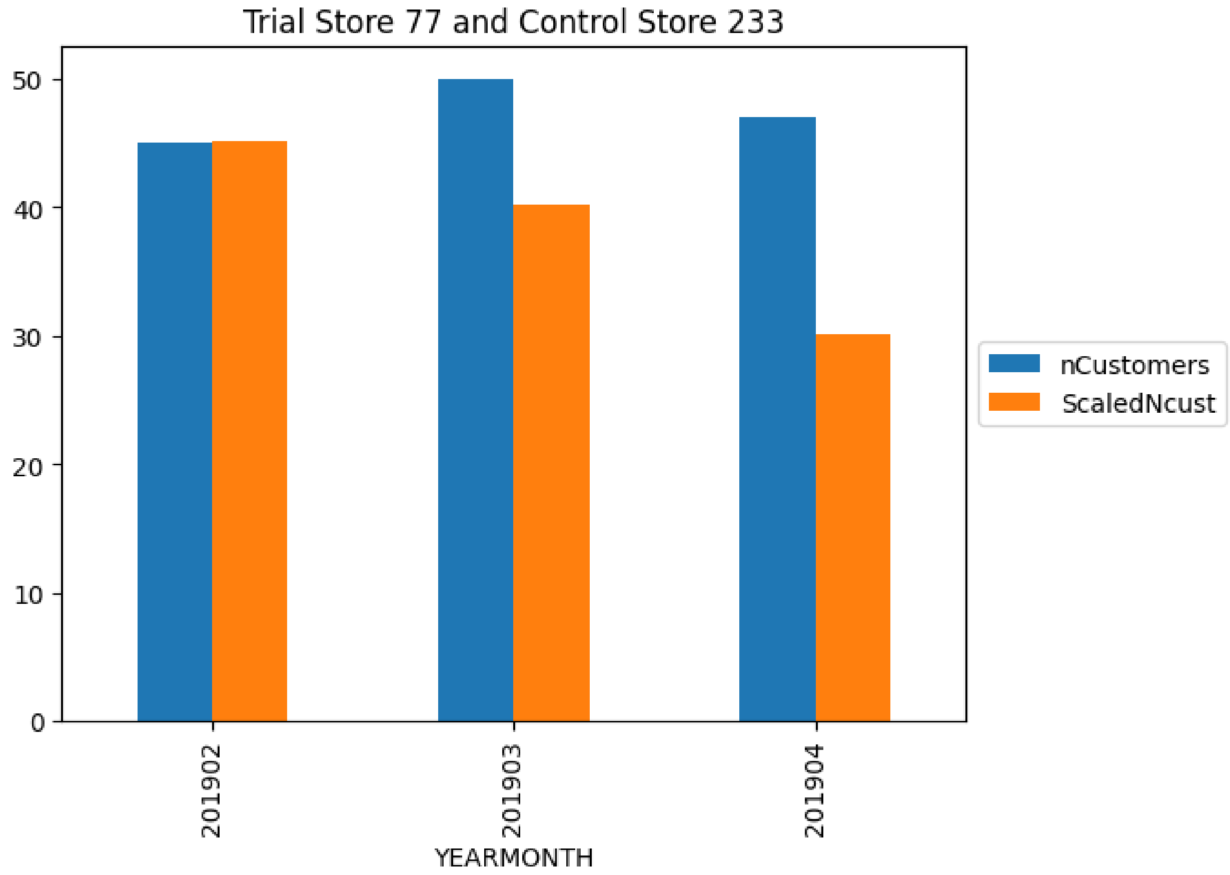


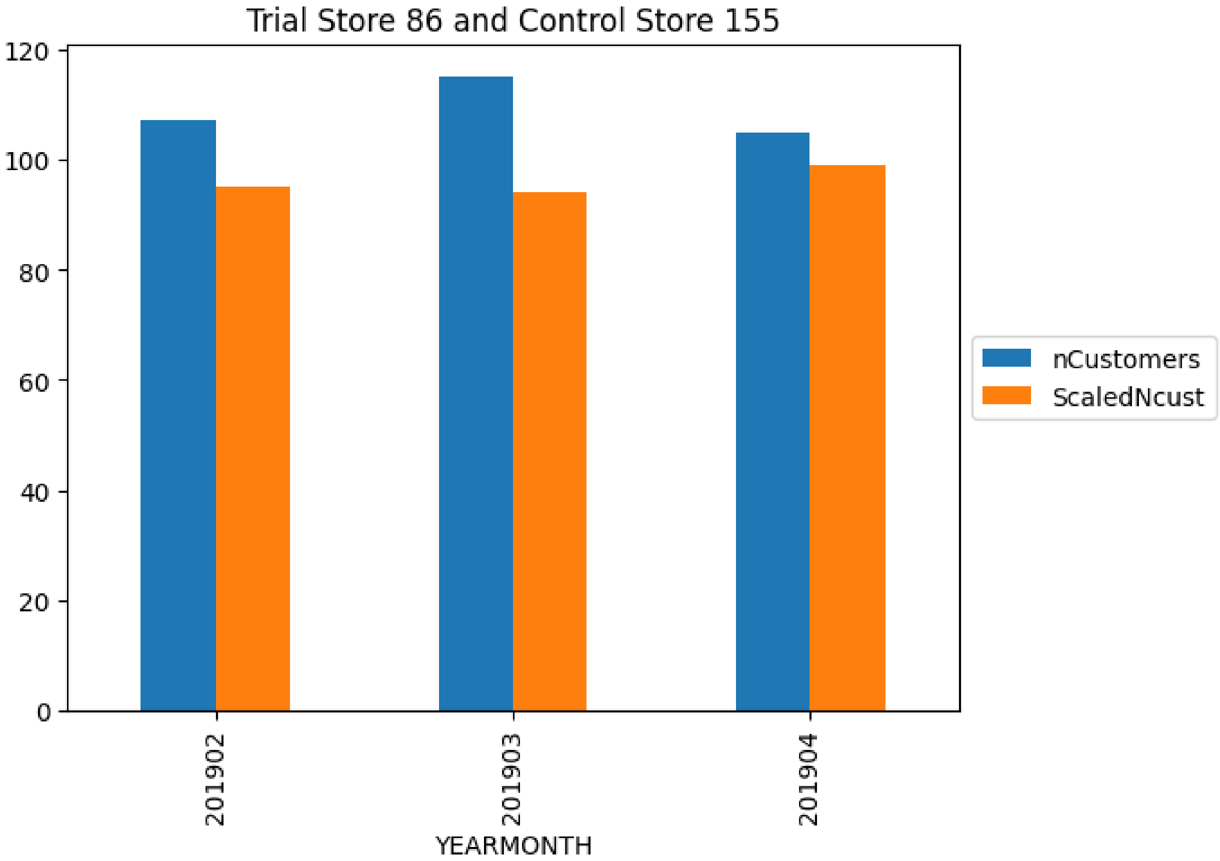

Trial Store 86 and Control Store 155 - Total Sales
1000
800
600
400
200
0
201902
201903
201904
YEARMONTH
95% threshold
5% threshold
trial_TOT_SALES
control_TOT_SALES

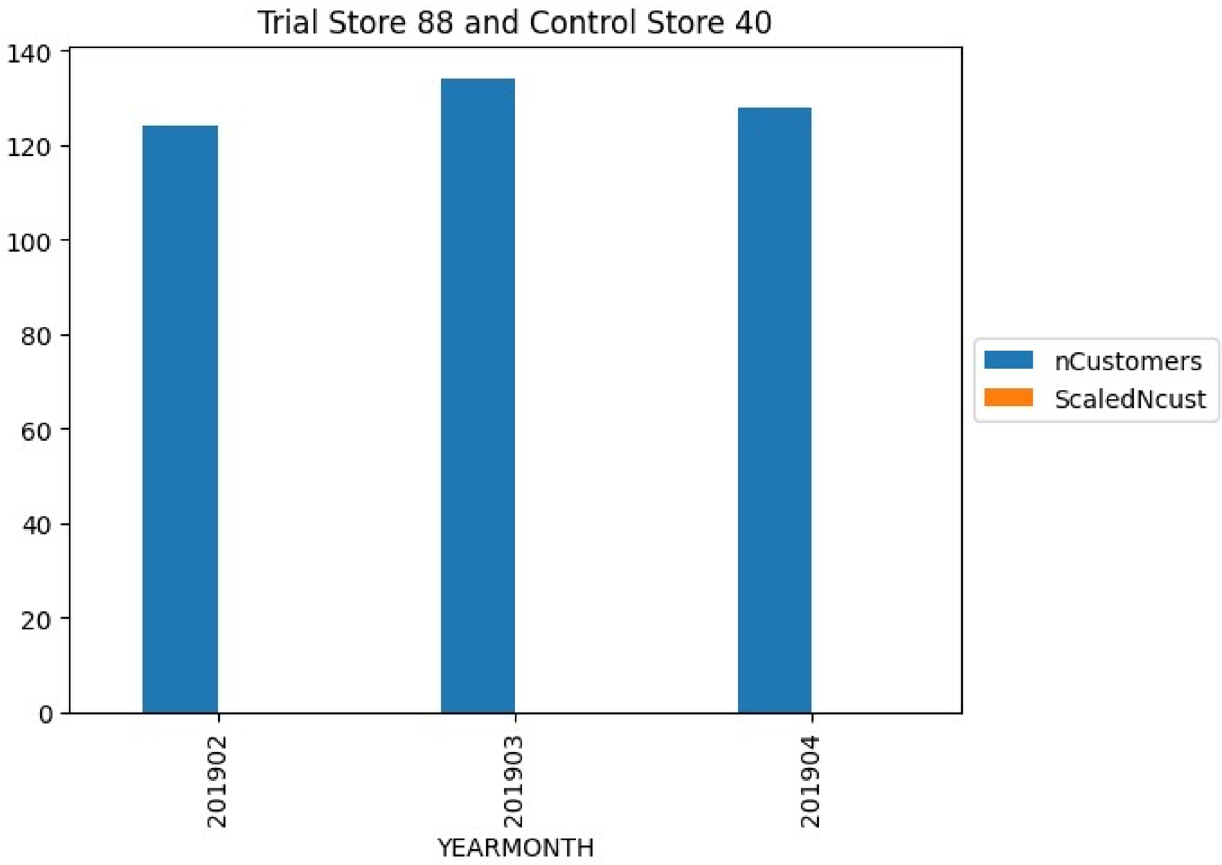

Trial Store 88 and Control Store 40 - Total Sales
1400
1200
1000
800
600
400
200
0
201902
201903
201904
YEARMONTH
95% threshold
5% threshold
trial_TOT_SALES
control_TOT_SALES

```
#Ratio of Store 77 and its Control store.
ncust_ratio_77 =
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 77]
["nCustomers"].sum() /
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 233]
["nCustomers"].sum()

#Ratio of Store 86 and its Control store.
ncust_ratio_86 =
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 86]
["nCustomers"].sum() /
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 155]
["nCustomers"].sum()

#Ratio of Store 77 and its Control store.
ncust_ratio_88 =
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 88]
["nCustomers"].sum() /
pretrial_full_observ[pretrial_full_observ["STORE_NBR"] == 40]
["nCustomers"].sum()

#trial_full_observ = full_observ[(full_observ["YEARMONTH"] >= 201902)
& (full_observ["YEARMONTH"] <= 201904)]
scaled_ncust_control_stores =
full_observ[full_observ["STORE_NBR"].isin([233, 155, 40])]
[["STORE_NBR", "YEARMONTH", "nCustomers"]]

def scaler_c(row):
    if row["STORE_NBR"] == 233:
        return row["nCustomers"] * ncust_ratio_77
    elif row["STORE_NBR"] == 155:
        return row["nCustomers"] * ncust_ratio_86
    elif row["STORE_NBR"] == 40:
        return row["nCustomers"] * ncust_ratio_88

scaled_ncust_control_stores["ScaledNcust"] =
scaled_ncust_control_stores.apply(lambda row: scaler_c(row), axis=1)

trial_scaled_ncust_control_stores =
scaled_ncust_control_stores[(scaled_ncust_control_stores["YEARMONTH"]
>= 201902) & (scaled_ncust_control_stores["YEARMONTH"] <= 201904)]
pretrial_scaled_ncust_control_stores =
scaled_ncust_control_stores[scaled_ncust_control_stores["YEARMONTH"] <
201902]

ncust_percentage_diff = {}

for trial, control in trial_control_dic.items():
    a =
trial_scaled_ncust_control_stores[trial_scaled_ncust_control_stores["S
TORE_NBR"] == control]
    b = trial_full_observ[trial_full_observ["STORE_NBR"] == trial]
[["STORE_NBR", "YEARMONTH", "nCustomers"]]
    ncust_percentage_diff[trial] = b["nCustomers"].sum() /
a["ScaledNcust"].sum()
    b[["YEARMONTH", "nCustomers"]].merge(a[["YEARMONTH",
"ScaledNcust"]],on="YEARMONTH").set_index("YEARMONTH").rename(columns=
{"ScaledSales":"Scaled_Control_nCust",
"TOT_SALES":"Trial_nCust"}).plot.bar()
    plt.legend(loc='center left', bbox_to_anchor=(1.0, 0.5))
    plt.title("Trial Store "+str(trial)+" and Control Store
"+str(control))
```

```
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\3591192806.py:6:
RuntimeWarning: divide by zero encountered in scalar divide
  ncust_percentage_diff[trial] = b["nCustomers"].sum() /
a["ScaledNcust"].sum()
```




Trial Store 86 and Control Store 155
120
100
80
60
40
20
0
201902
201903
201904
YEARMONTH
nCustomers
ScaledNcust



```
ncust_percentage_diff
```

```
{77: 1.2306529009742622, 86: 1.1354166666666667, 88:
1.0444876946258161}
```

```
#Creating a compiled ncust_percentage_difference table
temp1 = scaled_ncust_control_stores.sort_values(by=["STORE_NBR",
"YEARMONTH"], ascending=[False,
True]).reset_index().drop(["nCustomers", "index"], axis=1)
temp2 = full_observ[full_observ["STORE_NBR"].isin([77,86,88])]
[["STORE_NBR", "YEARMONTH",
"nCustomers"]].reset_index().drop(["index", "YEARMONTH"], axis=1)
scaledncust_vs_trial = pd.concat([temp1, temp2], axis=1)
scaledncust_vs_trial.columns = ["c_STORE_NBR", "YEARMONTH",
"c_ScaledNcust", "t_STORE_NBR", "t_nCustomers"]
scaledncust_vs_trial["nCust_Percentage_Diff"] =
(scaledncust_vs_trial["t_nCustomers"] -
scaledncust_vs_trial["c_ScaledNcust"]) /
(((scaledncust_vs_trial["t_nCustomers"] +
scaledncust_vs_trial["c_ScaledNcust"])/2))

scaledncust_vs_trial["trial_period"] =
scaledncust_vs_trial["YEARMONTH"].apply(lambda cell:
```

```
label_period(cell))
scaledncust_vs_trial[scaledncust_vs_trial["trial_period"] == "trial"]

    c_STORE_NBR  YEARMONTH  c_ScaledNcust  t_STORE_NBR
t_nCustomers  \
7           233     201902      45.151007           77             45

8           233     201903      40.134228           77             50

9           233     201904      30.100671           77             47

19          155     201902      95.000000           86            107

20          155     201903      94.000000           86            115

21          155     201904      99.000000           86            105

31           40     201902     127.610209           88            124

32           40     201903     120.464037           88            134

33           40     201904     121.484919           88            128


    nCust_Percentage_Diff trial_period
7               -0.003350        trial
8                0.218913        trial
9                0.438370        trial
19               0.118812        trial
20               0.200957        trial
21               0.058824        trial
31              -0.028697        trial
32               0.106388        trial
33               0.052228        trial
```

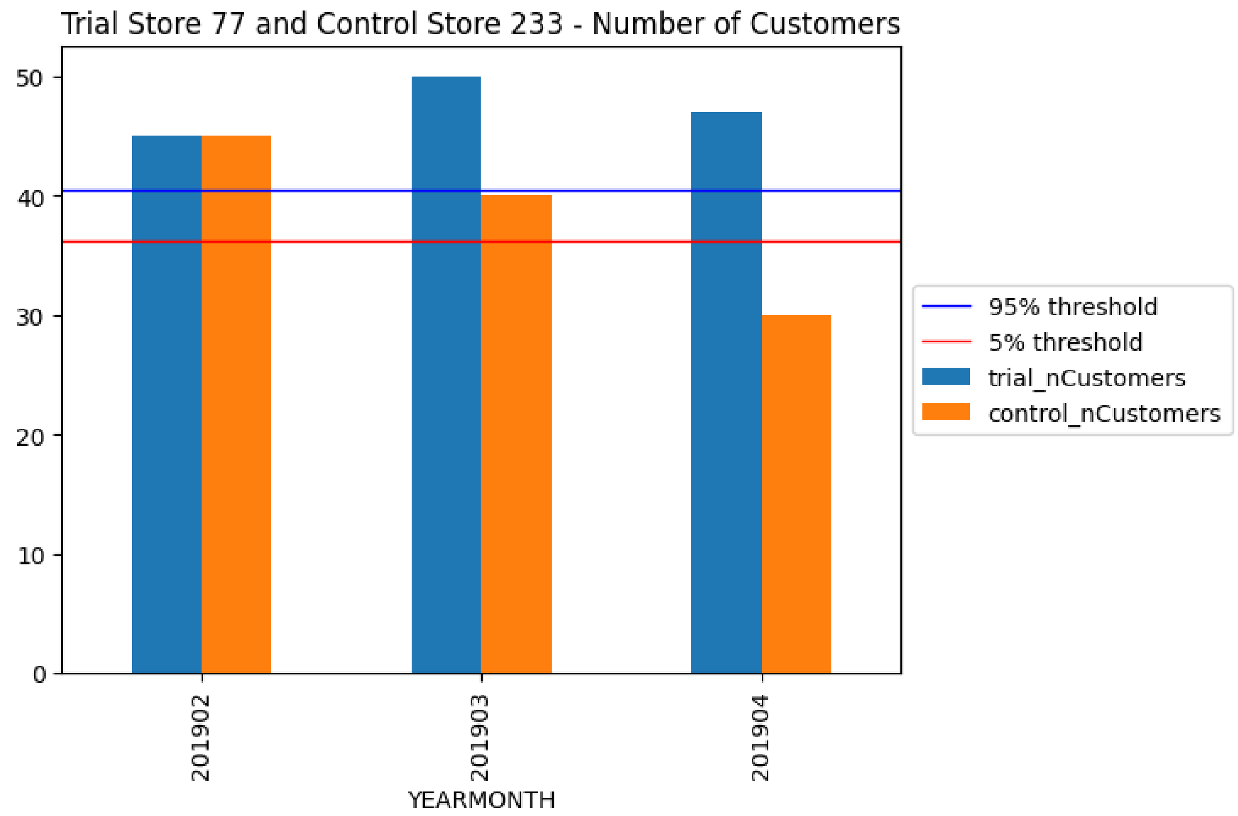
```
# Step 1
for num in [40, 155, 233]:
    print("Store", num)

print(ttest_ind(pretrial_scaled_ncust_control_stores[pretrial_scaled_n
cust_control_stores["STORE_NBR"] == num]["ScaledNcust"],

trial_scaled_ncust_control_stores[trial_scaled_ncust_control_stores["S
TORE_NBR"] == num]["ScaledNcust"],
                   equal_var=False), '\n')

alpha = 0.05
print("Critical t-value for 95% confidence interval:")
print(t.ppf((alpha/2, 1-alpha/2),
df=min([len(pretrial_scaled_ncust_control_stores[pretrial_scaled_ncust
_control_stores["STORE_NBR"] == num]),

len(trial_scaled_ncust_control_stores[trial_scaled_ncust_control_store
s["STORE_NBR"] == num])])-1))

Store 40
TtestResult(statistic=0.644732693420032, pvalue=0.5376573016017127,
df=7.7735551763644395)

Store 155
TtestResult(statistic=1.3888888888888882, pvalue=0.204345986327886,
df=7.572528547077964)

Store 233
TtestResult(statistic=0.8442563765225701, pvalue=0.4559280037660254,
df=3.2638055826510652)

Critical t-value for 95% confidence interval:
[-4.30265273  4.30265273]

# Step 2
for trial, cont in trial_control_dic.items():
    print("Trial store:", trial, ", Control store:", cont)

print(ttest_ind(pretrial_full_observ[pretrial_full_observ["STORE_NBR"]
== trial]["nCustomers"],

pretrial_scaled_ncust_control_stores[pretrial_scaled_ncust_control_sto
res["STORE_NBR"] == cont]["ScaledNcust"],
                   equal_var=True), '\n')

alpha = 0.05
print("Critical t-value for 95% confidence interval:")
print(t.ppf((alpha/2, 1-alpha/2),
df=len(pretrial_full_observ[pretrial_full_observ["STORE_NBR"] ==
trial])-1))

Trial store: 77 , Control store: 233
TtestResult(statistic=0.0, pvalue=1.0, df=12.0)

Trial store: 86 , Control store: 155
TtestResult(statistic=0.0, pvalue=1.0, df=12.0)

Trial store: 88 , Control store: 40
TtestResult(statistic=-7.648483953264653e-15,
pvalue=0.9999999999999994, df=12.0)

Critical t-value for 95% confidence interval:
[-2.44691185  2.44691185]
```

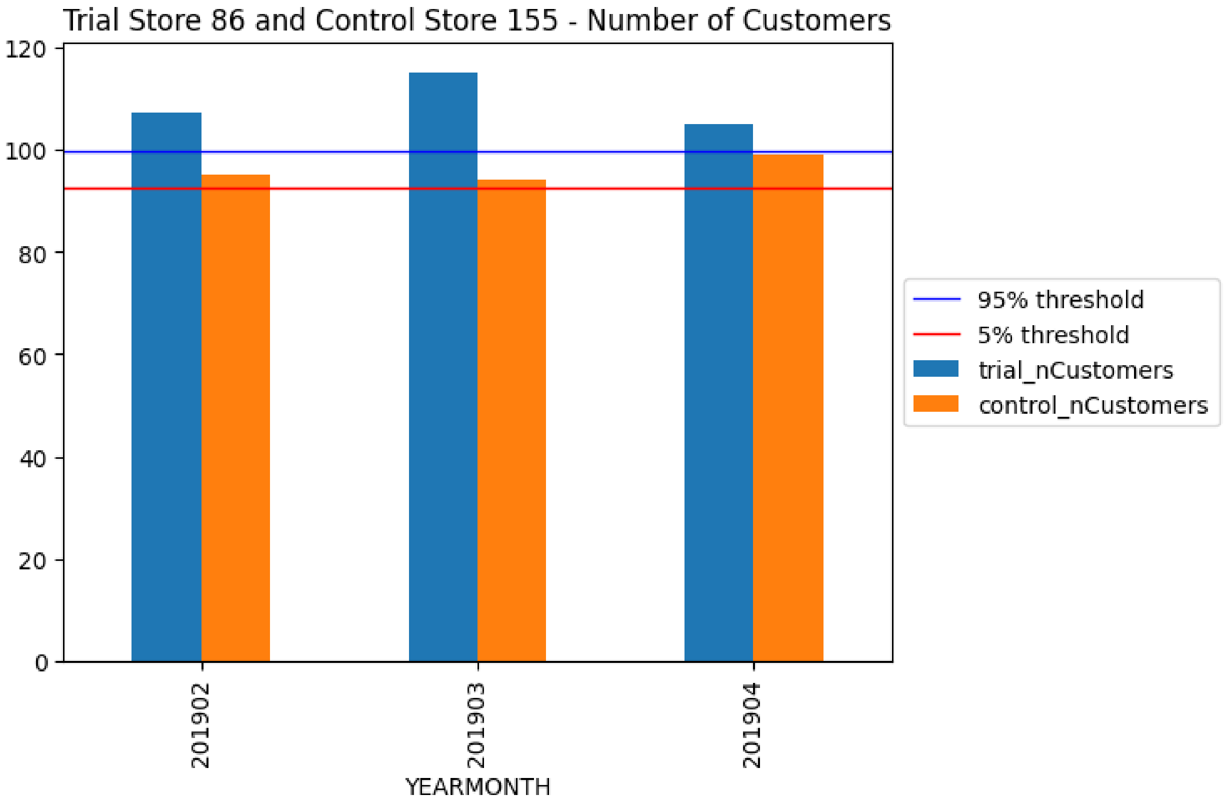
```
# Step 3
for trial, cont in trial_control_dic.items():
    print("Trial store:", trial, ", Control store:", cont)
    temp_pre =
scaledncust_vs_trial[(scaledncust_vs_trial["c_STORE_NBR"] == cont) &
(scaledncust_vs_trial["trial_period"]=="pre")]
    std = temp_pre["nCust_Percentage_Diff"].std()
    mean = temp_pre["nCust_Percentage_Diff"].mean()
    #print(std, mean)
    for t_month in
scaledncust_vs_trial[scaledncust_vs_trial["trial_period"] == "trial"]
["YEARMONTH"].unique():
        pdif = scaledncust_vs_trial[(scaledncust_vs_trial["YEARMONTH"]
== t_month) & (scaledncust_vs_trial["t_STORE_NBR"] == trial)]
["nCust_Percentage_Diff"]
        print(t_month,":",(float(pdif)-mean)/std)
    print('\n')

print("Critical t-value for 95% confidence interval:")
conf_intv_95 = t.ppf(0.95, df=len(temp_pre)-1)
print(conf_intv_95)
```

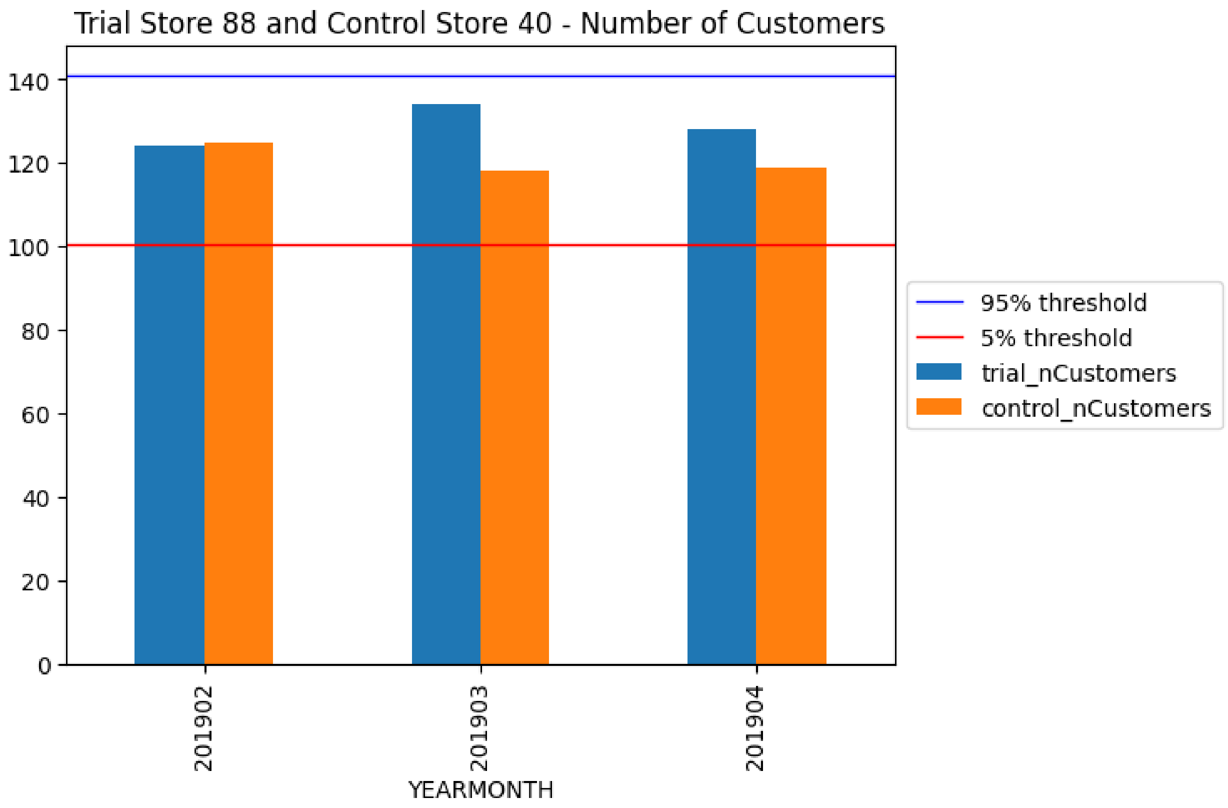
```
Trial store: 77 , Control store: 233
201902 : -0.19886295797440687
201903 : 8.009609025380932
201904 : 16.114474772873923


Trial store: 86 , Control store: 155
201902 : 6.220524882227514
201903 : 10.52599074274189
201904 : 3.0763575852842706


Trial store: 88 , Control store: 40
201902 : -0.3592881735131531
201903 : 1.2575196020616801
201904 : 0.6092905590514273


Critical t-value for 95% confidence interval:
1.9431802805153018
```

```
C:\Users\Lenovo\AppData\Local\Temp\ipykernel_7196\3881378290.py:10:
FutureWarning: Calling float on a single element Series is deprecated
and will raise a TypeError in the future. Use float(ser.iloc[0])
instead
  print(t_month,":",(float(pdif)-mean)/std)
```

```
for trial, control in trial_control_dic.items():
    a =
trial_scaled_ncust_control_stores[trial_scaled_ncust_control_stores["S
TORE_NBR"] == control].rename(columns={"nCustomers":
"control_nCustomers"})
    b = trial_full_observ[trial_full_observ["STORE_NBR"] == trial]
[["STORE_NBR", "YEARMONTH",
"nCustomers"]].rename(columns={"nCustomers": "trial_nCustomers"})
    comb = b[["YEARMONTH", "trial_nCustomers"]].merge(a[["YEARMONTH",
"control_nCustomers"]],on="YEARMONTH").set_index("YEARMONTH")
    comb.plot.bar()
    cont_sc_ncust =
trial_scaled_ncust_control_stores[trial_scaled_ncust_control_stores["S
TORE_NBR"] == control]["nCustomers"]
    std = scaledncust_vs_trial[(scaledncust_vs_trial["c_STORE_NBR"] ==
control) & (scaledncust_vs_trial["trial_period"]=="pre")]
["nCust_Percentage_Diff"].std()
    thresh95 = cont_sc_ncust.mean() + (cont_sc_ncust.mean() * std * 2)
    thresh5 = cont_sc_ncust.mean() - (cont_sc_ncust.mean() * std * 2)
    plt.axhline(y=thresh95,linewidth=1, color='b', label="95%
threshold")
    plt.axhline(y=thresh5,linewidth=1, color='r', label="5%
threshold")
    plt.legend(loc='center left', bbox_to_anchor=(1.0, 0.5))
    plt.title("Trial Store "+str(trial)+" and Control Store
"+str(control)+" - Number of Customers")
    plt.savefig("TS {} and CS {} -
nCustomers.png".format(trial,control), bbox_inches="tight")
```


Trial Store 77 and Control Store 233 - Number of Customers
0
10
20
30
40
50
201902
201903
201904
YEARMONTH
95% threshold
5% threshold
trial_nCustomers
control_nCustomers


Trial Store 86 and Control Store 155 - Number of Customers
0
20
40
60
80
100
120
201902
201903
201904
YEARMONTH
95% threshold
5% threshold
trial_nCustomers
control_nCustomers


Trial Store 88 and Control Store 40 - Number of Customers
0
20
40
60
80
100
120
140
201902
201903
201904
YEARMONTH
95% threshold
5% threshold
trial_nCustomers
control_nCustomers