In [1]:

```
import pandas as pd
import numpy as np
from IPython.display import Image  # To display images in jupyter notebook
from matplotlib import pyplot as plt
import seaborn as sns
plt.style.use("ggplot")
```

In [2]:

```
df = pd.read_excel(io='Merged_data_frame.xlsx', sheet_name=0)
```

In [3]:

```
# df['STORE_NBR'].unique()
```

In [4]:

```
df.drop('Unnamed: 0', inplace=True, axis=1)
df.head()
```

Out[4]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	TO
0	2018-10-17	1	1000	1	5	Natural Chip Compny SeaSalt	2	
1	2019-05-14	1	1307	348	66	CCs Nacho Cheese	3	
2	2018-11-10	1	1307	346	96	WW Original Stacked Chips	2	
3	2019-03-09	1	1307	347	54	CCs Original	1	
4	2019-05-20	1	1343	383	61	Smiths Crinkle Cut Chips Chicken	2	

In [5]:

```
# Make Month as new column, by seperating months form date

months = [str(date).split('-')[1] for date in df['DATE']]
df['MONTH'] = months
```

In [6]:

```
# Save to excel file
df.to_excel(excel_writer='Merged_data_frame.xlsx', sheet_name='Sheet1')
```

Part-1

Find Control Stores

In [7]:

```
import datetime

jul_first_date = '2018-7-1'
jan_last_date =  '2019-1-31'

# Select Stores from 2018-7-1 to 2019-1-31

filter_mask = ((df['DATE'] >= jul_first_date) & (df['DATE'] <= jan_last_date))

pre_trial_df = df[filter_mask]
pre_trial_df.head()
```

Out[7]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	T
0	2018-10-17	1	1000	1	5	Natural Chip Compny SeaSalt	2	
2	2018-11-10	1	1307	346	96	WW Original Stacked Chips	2	
5	2018-08-17	2	2373	974	69	Smiths Chip Thinly S/Cream&Onion	5	
6	2018-08-18	2	2426	1038	108	Kettle Tortilla ChpsHny&Jlpno Chili	3	
8	2018-08-06	4	4074	2978	70	Tyrrells Crisps Lightly Salted	2	

In [8]:

```
# Get Stores 88, 77, 86 under pre trial period.
msk1 = ((pre_trial_df['STORE_NBR'] == 77) | (pre_trial_df['STORE_NBR'] == 86) | (pre_trial_
df1 = pre_trial_df[msk1]

# Get Stores other than 88, 77, 86 under pre trial period.
msk2 = ~((pre_trial_df['STORE_NBR'] == 77) | (pre_trial_df['STORE_NBR'] == 86) | (pre_trial
df2 = pre_trial_df[msk2]
```

In [9]:

```
df1.head()
```

Out[9]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_Q
295	2018-07-07	88	88320	87804	47	Doritos Corn Chips Original	
296	2018-07-16	88	88320	87805	9	Kettle Tortilla ChpsBtroot&Ricotta	
297	2018-09-17	88	88320	87806	65	Old El Paso Salsa Dip Chnky Tom Ht	
298	2018-09-29	88	88320	87807	74	Tostitos Splash Of Lime	
299	2018-10-29	88	88320	87808	90	Tostitos Smoked Chipotle	

In [10]:

```
# Data of Store 77

sales_sum_store_77 = df1[df1['STORE_NBR'] == 77]['TOT_SALES'].sum()
total_customer_count_store_77 = len(df1[df1['STORE_NBR'] == 77]['LYLTY_CARD_NBR'].unique())
total_transaction_count_store_77 = len(df1[df1['STORE_NBR'] == 77]['TXN_ID'].unique())
```

In [11]:

```
# Data of Store 86

sales_sum_store_86 = df1[df1['STORE_NBR'] == 86]['TOT_SALES'].sum()
total_customer_count_store_86 = len(df1[df1['STORE_NBR'] == 86]['LYLTY_CARD_NBR'].unique())
total_transaction_count_store_86 = len(df1[df1['STORE_NBR'] == 86]['TXN_ID'].unique())
```

In [12]:

```
# Data of Store 88

sales_sum_store_88 = df1[df1['STORE_NBR'] == 88]['TOT_SALES'].sum()
total_customer_count_store_88 = len(df1[df1['STORE_NBR'] == 88]['LYLTY_CARD_NBR'].unique())
total_transaction_count_store_88 = len(df1[df1['STORE_NBR'] == 88]['TXN_ID'].unique())
```

In [13]:

```
# Store ID's that has Closest total revenue for store id's 77, 86, 88 respectively

def closest(lst, K): # Find closest value to value k in the lst.
        return lst[min(range(len(lst)), key = lambda i: abs(lst[i]-K))]

dict_sum_sales_store_77 = {}
dict_sum_sales_store_86 = {}
dict_sum_sales_store_88 = {}

for st in [sales_sum_store_77, sales_sum_store_86, sales_sum_store_88]:
    all_stores = list(df2['STORE_NBR'].unique())

    rank = 1

    for store in all_stores:
        if rank <= 20:
            temp_list = list()

            for store_id in all_stores:
                msk = (df2['STORE_NBR'] == store_id)
                temp_df = df2[msk]
                t_sum = temp_df['TOT_SALES'].sum()

                temp_list.append([store_id, t_sum])

            value = closest(np.array(temp_list)[:, 1:], st)[0]

            for s, summ in temp_list:
                if summ == value:
                    if st == sales_sum_store_77:
                        dict_sum_sales_store_77[s] = rank
                    elif st == sales_sum_store_86:
                        dict_sum_sales_store_86[s] = rank
                    elif st == sales_sum_store_88:
                        dict_sum_sales_store_88[s] = rank
                    all_stores.remove(s)
                    rank += 1
```

In [14]:

```
# Store ID's that has Closest Total Customer Count for store id's 77, 86, 88 respectively.

def closest(lst, K): # Find closest value to value k in the lst.
        return lst[min(range(len(lst)), key = lambda i: abs(lst[i]-K))]

dict_customer_count_77 = {}
dict_customer_count_86 = {}
dict_customer_count_88 = {}

for st in [total_customer_count_store_77, total_customer_count_store_86, total_customer_cou
    all_stores = list(df2['STORE_NBR'].unique())

    rank = 1

    for store in all_stores:
        if rank <= 20:
            temp_list = list()

            for store_id in all_stores:
                msk = (df2['STORE_NBR'] == store_id)
                temp_df = df2[msk]
                t_sum = len(temp_df['LYLTY_CARD_NBR'].unique())

                temp_list.append([store_id, t_sum])

            value = closest(np.array(temp_list)[:, 1:], st)[0]

            for s, summ in temp_list:
                if summ == value:
                    if st == total_customer_count_store_77:
                        dict_customer_count_77[s] = rank
                    elif st == total_customer_count_store_86:
                        dict_customer_count_86[s] = rank
                    elif st == total_customer_count_store_88:
                        dict_customer_count_88[s] = rank
                    all_stores.remove(s)
                    rank += 1
```

In [15]:

```
# Store ID's that has Closest Total Transaction Count for store id's 77, 86, 88 respectivel

def closest(lst, K): # Find closest value to value k in the lst.
        return lst[min(range(len(lst)), key = lambda i: abs(lst[i]-K))]

dict_transaction_count_77 = {}
dict_transaction_count_86 = {}
dict_transaction_count_88 = {}

for st in [total_transaction_count_store_77, total_transaction_count_store_86, total_transa

    all_stores = list(df2['STORE_NBR'].unique())

    rank = 1

    for store in all_stores:
        if rank <= 20:
            temp_list = list()

            for store_id in all_stores:
                msk = (df2['STORE_NBR'] == store_id)
                temp_df = df2[msk]
                t_sum = len(temp_df['TXN_ID'].unique())

                temp_list.append([store_id, t_sum])

            value = closest(np.array(temp_list)[:, 1:], st)[0]

            for s, summ in temp_list:
                if summ == value:
                    if st == total_transaction_count_store_77:
                        dict_transaction_count_77[s] = rank
                    elif st == total_transaction_count_store_86:
                        dict_transaction_count_86[s] = rank
                    elif st == total_transaction_count_store_88:
                        dict_transaction_count_88[s] = rank
                    all_stores.remove(s)
                    rank += 1
```

In [16]:

```
d11 =  pd.DataFrame(data = list(zip(dict_sum_sales_store_77.values(), dict_sum_sales_store_
d12 = pd.DataFrame(data = list(zip(dict_customer_count_77.values(), dict_customer_count_77.
d13 = pd.DataFrame(data = list(zip(dict_transaction_count_77.values(), dict_transaction_cou

merged_df = pd.merge(left=d11, right=d12, how='inner', on='Store')
merged_df = pd.merge(left=merged_df, right=d13, how='inner', on='Store')
merged_df['Rank Sum'] = merged_df['Rank_x'] + merged_df['Rank_y'] + merged_df['Rank']
merged_df.rename(columns={'Rank_x': 'Total sales Rank', 'Rank_y': 'Customer Count Rank', 'R
merged_df.sort_values('Rank Sum')
```

Out[16]:

	Total sales Rank	Store	Customer Count Rank	Transaction Count Rank	Rank Sum
1	7	6	12	9	28
0	4	233	16	18	38

In [17]:

```
d11 =  pd.DataFrame(data = list(zip(dict_sum_sales_store_86.values(), dict_sum_sales_store_
d12 = pd.DataFrame(data = list(zip(dict_customer_count_86.values(), dict_customer_count_86.
d13 = pd.DataFrame(data = list(zip(dict_transaction_count_86.values(), dict_transaction_cou

merged_df = pd.merge(left=d11, right=d12, how='inner', on='Store')
merged_df = pd.merge(left=merged_df, right=d13, how='inner', on='Store')
merged_df['Rank Sum'] = merged_df['Rank_x'] + merged_df['Rank_y'] + merged_df['Rank']
merged_df.rename(columns={'Rank_x': 'Total sales Rank', 'Rank_y': 'Customer Count Rank', 'R
merged_df.sort_values('Rank Sum')
```

Out[17]:

	Total sales Rank	Store	Customer Count Rank	Transaction Count Rank	Rank Sum
0	6	57	3	3	12
1	8	207	12	9	29
2	14	122	22	15	51

In [18]:

```
d11 =  pd.DataFrame(data = list(zip(dict_sum_sales_store_88.values(), dict_sum_sales_store_
d12 = pd.DataFrame(data = list(zip(dict_customer_count_88.values(), dict_customer_count_88.
d13 = pd.DataFrame(data = list(zip(dict_transaction_count_88.values(), dict_transaction_cou

merged_df = pd.merge(left=d11, right=d12, how='inner', on='Store')
merged_df = pd.merge(left=merged_df, right=d13, how='inner', on='Store')
merged_df['Rank Sum'] = merged_df['Rank_x'] + merged_df['Rank_y'] + merged_df['Rank']
merged_df.rename(columns={'Rank_x': 'Total sales Rank', 'Rank_y': 'Customer Count Rank', 'R
merged_df.sort_values('Rank Sum')
```

Out[18]:

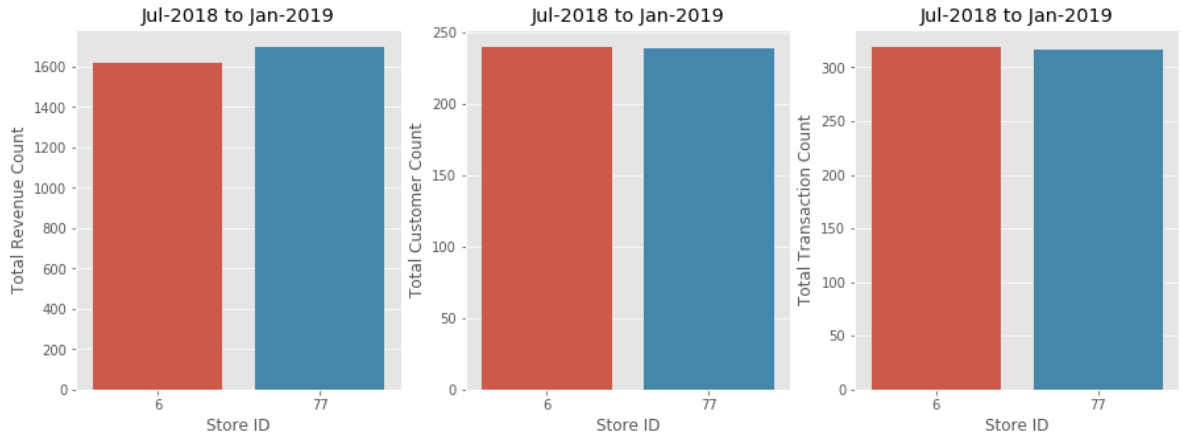
	Total sales Rank	Store	Customer Count Rank	Transaction Count Rank	Rank Sum
2	3	58	2	4	9
0	1	237	8	1	10
1	2	165	5	5	12
4	5	203	3	10	18
5	6	40	4	12	22
3	4	4	14	6	24
7	8	226	7	20	35
6	7	199	16	18	41

In [19]:

```
# <<<--- Plot the Data for Store 77 and 6 --->>>

fig1, ax1 =plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.barplot(x=['77', '6'], y=[sales_sum_store_77, df2[df2['STORE_NBR']==6]['TOT_SALES'].sum
ax1[0].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['77', '6'], y=[total_customer_count_store_77,  len(df2[df2['STORE_NBR']==6][
ax1[1].set(xlabel="Store ID", ylabel='Total Customer Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['77', '6'], y=[total_transaction_count_store_77, len(df2[df2['STORE_NBR']==6
ax1[2].set(xlabel="Store ID", ylabel='Total Transaction Count', title='Jul-2018 to Jan-2019
```

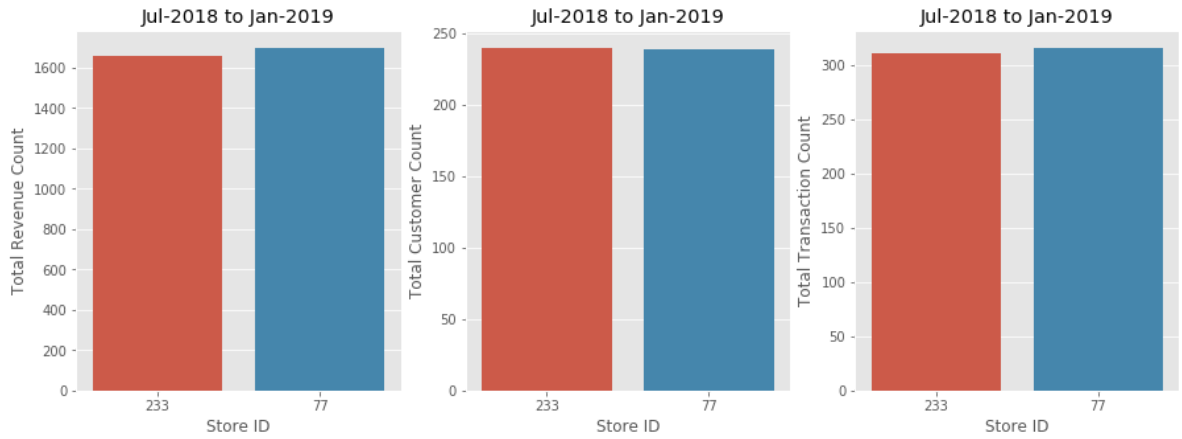
Out[19]:

```
[Text(0, 0.5, 'Total Transaction Count'),
 Text(0.5, 0, 'Store ID'),
 Text(0.5, 1.0, 'Jul-2018 to Jan-2019')]
```



In [20]:

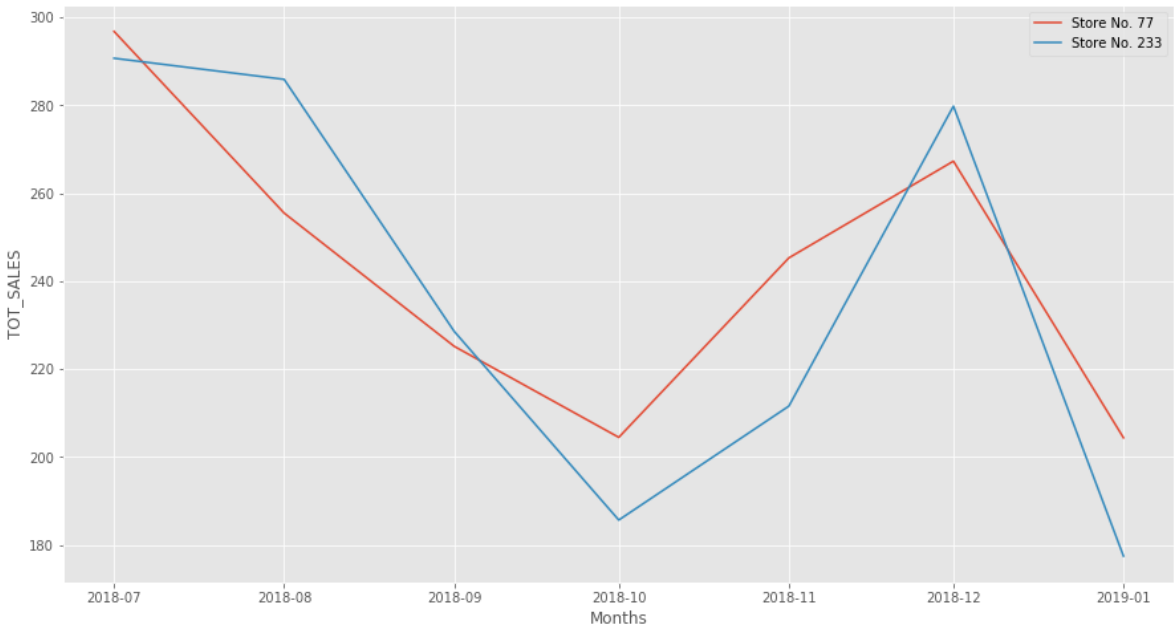
```
# <<<--- Plot the Data for Store 77 and 233 --->>>

fig1, ax1 =plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.barplot(x=['77', '233'], y=[sales_sum_store_77, df2[df2['STORE_NBR']==233]['TOT_SALES']
ax1[0].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['77', '233'], y=[total_customer_count_store_77,  len(df2[df2['STORE_NBR']==2
ax1[1].set(xlabel="Store ID", ylabel='Total Customer Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['77', '233'], y=[total_transaction_count_store_77, len(df2[df2['STORE_NBR']=
ax1[2].set(xlabel="Store ID", ylabel='Total Transaction Count', title='Jul-2018 to Jan-2019

fig1.savefig('Task21.png')
```



In [21]:

```
import datetime

plt.figure(figsize=(15,8))

t_d1 = pre_trial_df[pre_trial_df['STORE_NBR'] == 77].groupby(by='MONTH').sum()
t_d1['Months'] = ['2019-1', '2018-7', '2018-8', '2018-9', '2018-10', '2018-11', '2018-12']
t_d1['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d1['Months']]

t_d2 = pre_trial_df[pre_trial_df['STORE_NBR'] == 233].groupby(by='MONTH').sum()
t_d2['Months'] = ['2019-1', '2018-7', '2018-8', '2018-9', '2018-10', '2018-11', '2018-12']
t_d2['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d2['Months']]

sns.lineplot(x=t_d1['Months'], y=t_d1['TOT_SALES'], legend='brief')
sns.lineplot(x=t_d2['Months'], y=t_d2['TOT_SALES'], legend='brief')

plt.legend(['Store No. 77', 'Store No. 233'])

fig1.savefig('Task22.png')
```

```
C:\Users\ASUS\Anaconda3\lib\site-packages\pandas\plotting\_matplotlib\conver
ter.py:103: FutureWarning: Using an implicitly registered datetime converter
for a matplotlib plotting method. The converter was registered by pandas on
import. Future versions of pandas will require you to explicitly register ma
tplotlib converters.

To register the converters:
        >>> from pandas.plotting import register_matplotlib_converters
        >>> register_matplotlib_converters()
  warnings.warn(msg, FutureWarning)
```



Results:

We got 2 stores (ie. store 6 and 233) as control store for 77. Both 6 and 233 are quite similar, but 233 is very slightly more similar to Store Id 77.

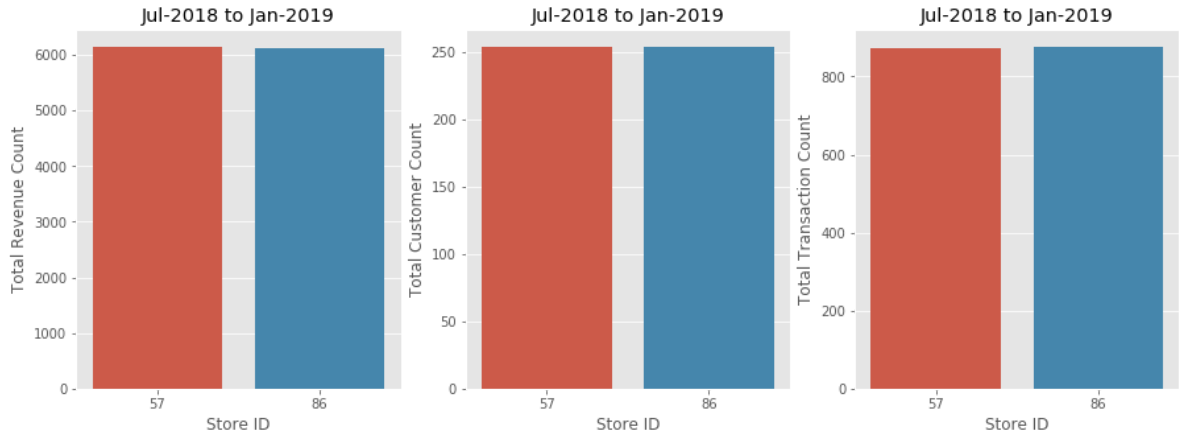
Therefore we select 233 as control store for Store id 77.

In [22]:

```
# <<<--- Plot the Data for Store 86 and 57 --->>>

fig1, ax1 =plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.barplot(x=['86', '57'], y=[sales_sum_store_86, df2[df2['STORE_NBR']==57]['TOT_SALES'].s
ax1[0].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['86', '57'], y=[total_customer_count_store_86,  len(df2[df2['STORE_NBR']==57
ax1[1].set(xlabel="Store ID", ylabel='Total Customer Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['86', '57'], y=[total_transaction_count_store_86, len(df2[df2['STORE_NBR']==
ax1[2].set(xlabel="Store ID", ylabel='Total Transaction Count', title='Jul-2018 to Jan-2019
```

Out[22]:

```
[Text(0, 0.5, 'Total Transaction Count'),
 Text(0.5, 0, 'Store ID'),
 Text(0.5, 1.0, 'Jul-2018 to Jan-2019')]
```

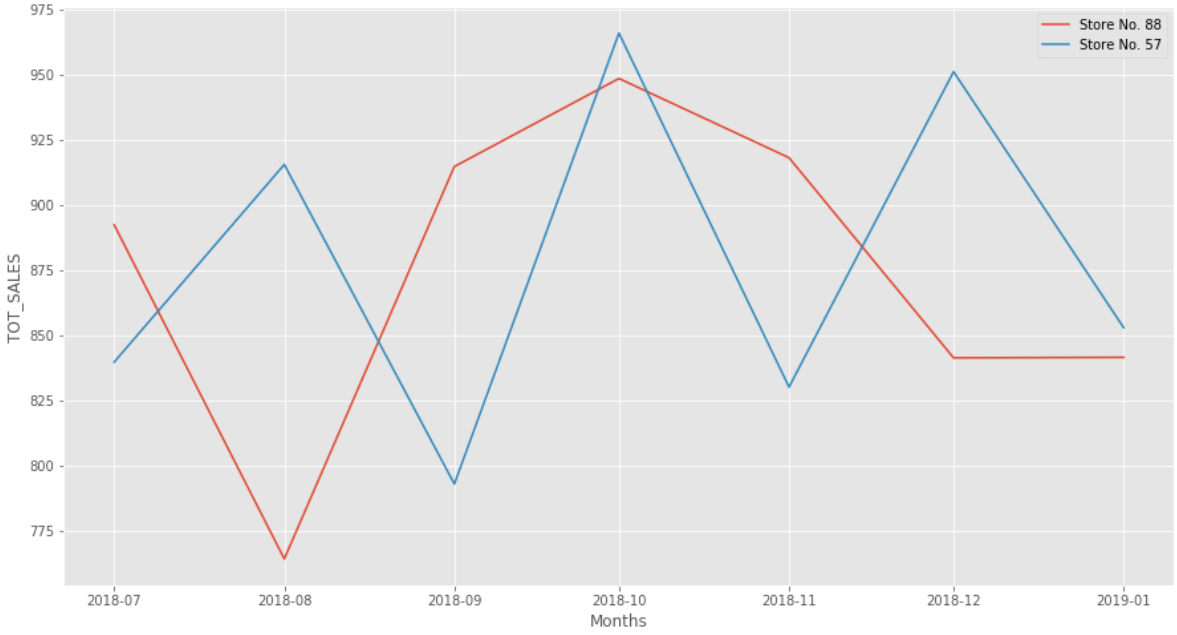


In [23]:

```
import datetime

plt.figure(figsize=(15,8))

t_d1 = pre_trial_df[pre_trial_df['STORE_NBR'] == 86].groupby(by='MONTH').sum()
t_d1['Months'] = ['2019-1', '2018-7', '2018-8', '2018-9', '2018-10', '2018-11', '2018-12']
t_d1['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d1['Months']]

t_d2 = pre_trial_df[pre_trial_df['STORE_NBR'] == 57].groupby(by='MONTH').sum()
t_d2['Months'] = ['2019-1', '2018-7', '2018-8', '2018-9', '2018-10', '2018-11', '2018-12']
t_d2['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d2['Months']]

sns.lineplot(x=t_d1['Months'], y=t_d1['TOT_SALES'], legend='brief')
sns.lineplot(x=t_d2['Months'], y=t_d2['TOT_SALES'], legend='brief')

plt.legend(['Store No. 88', 'Store No. 57'])
```

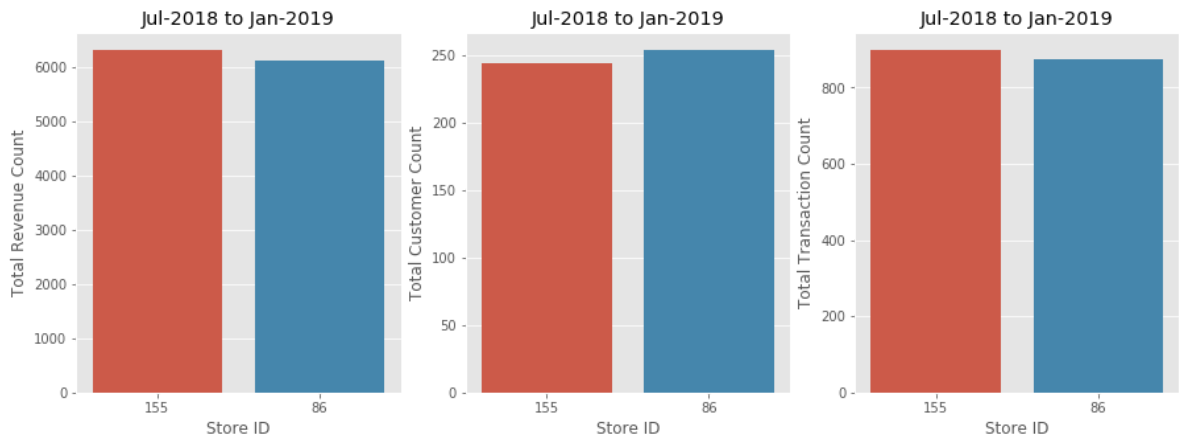
Out[23]:

```
<matplotlib.legend.Legend at 0x21bb6254908>
```



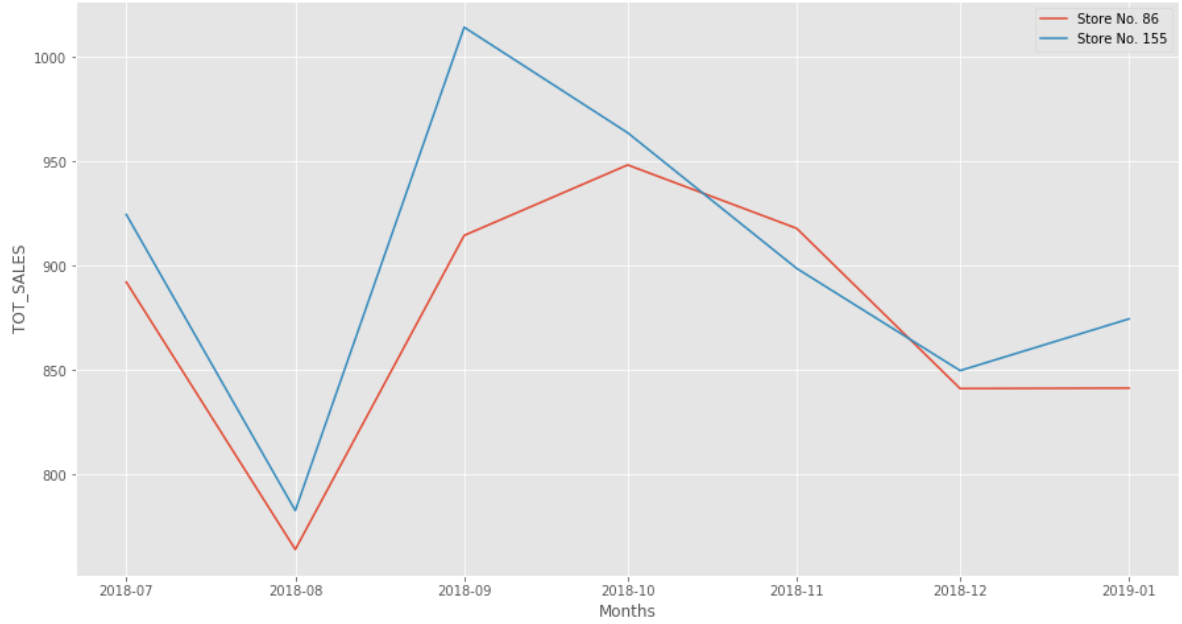
In [24]:

```
# <<<--- Plot the Data for Store 86 and 155 --->>>

fig1, ax1 =plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.barplot(x=['86', '155'], y=[sales_sum_store_86, df2[df2['STORE_NBR']==155]['TOT_SALES']
ax1[0].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['86', '155'], y=[total_customer_count_store_86,  len(df2[df2['STORE_NBR']==1
ax1[1].set(xlabel="Store ID", ylabel='Total Customer Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['86', '155'], y=[total_transaction_count_store_86, len(df2[df2['STORE_NBR']=
ax1[2].set(xlabel="Store ID", ylabel='Total Transaction Count', title='Jul-2018 to Jan-2019

fig1.savefig('Task23.png')
```



In [25]:

```
import datetime

plt.figure(figsize=(15,8))

t_d1 = pre_trial_df[pre_trial_df['STORE_NBR'] == 86].groupby(by='MONTH').sum()
t_d1['Months'] = ['2019-1', '2018-7', '2018-8', '2018-9', '2018-10', '2018-11', '2018-12']
t_d1['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d1['Months']]

t_d2 = pre_trial_df[pre_trial_df['STORE_NBR'] == 155].groupby(by='MONTH').sum()
t_d2['Months'] = ['2019-1', '2018-7', '2018-8', '2018-9', '2018-10', '2018-11', '2018-12']
t_d2['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d2['Months']]

sns.lineplot(x=t_d1['Months'], y=t_d1['TOT_SALES'], legend='brief')
sns.lineplot(x=t_d2['Months'], y=t_d2['TOT_SALES'], legend='brief')

plt.legend(['Store No. 86', 'Store No. 155'])

fig1.savefig('Task24.png')
```



Results:

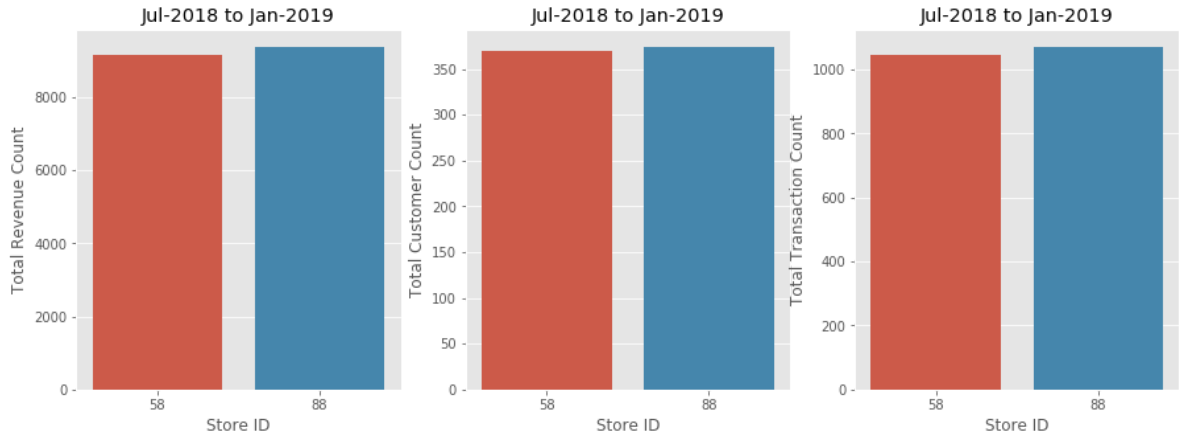
We got 155 as control store for Store id 86.

In [26]:

```
# <<<--- Plot the Data for Store 88 and 58 --->>>

fig1, ax1 =plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.barplot(x=['88', '58'], y=[sales_sum_store_88, df2[df2['STORE_NBR']==58]['TOT_SALES'].s
ax1[0].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['88', '58'], y=[total_customer_count_store_88,  len(df2[df2['STORE_NBR']==58
ax1[1].set(xlabel="Store ID", ylabel='Total Customer Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['88', '58'], y=[total_transaction_count_store_88, len(df2[df2['STORE_NBR']==
ax1[2].set(xlabel="Store ID", ylabel='Total Transaction Count', title='Jul-2018 to Jan-2019
```

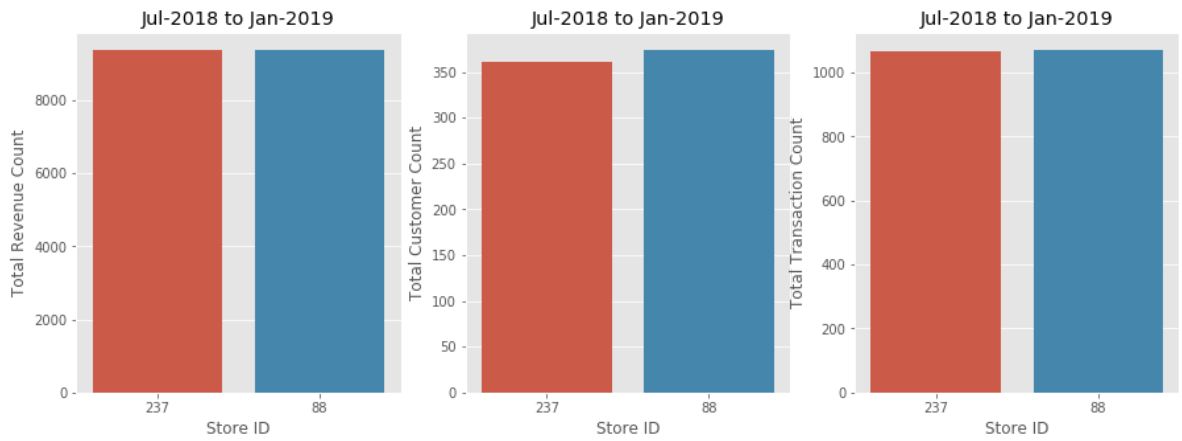
Out[26]:

```
[Text(0, 0.5, 'Total Transaction Count'),
 Text(0.5, 0, 'Store ID'),
 Text(0.5, 1.0, 'Jul-2018 to Jan-2019')]
```



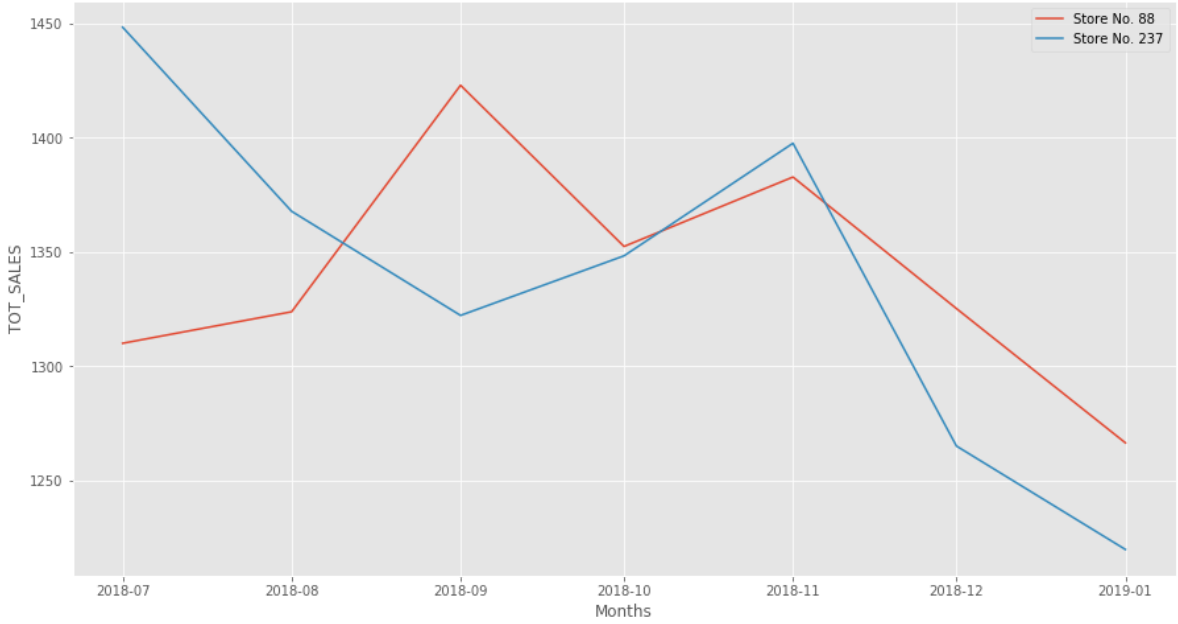
In [27]:

```
# <<<--- Plot the Data for Store 88 and 237 --->>>

fig1, ax1 =plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.barplot(x=['88', '237'], y=[sales_sum_store_88, df2[df2['STORE_NBR']==237]['TOT_SALES']
ax1[0].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['88', '237'], y=[total_customer_count_store_88,  len(df2[df2['STORE_NBR']==2
ax1[1].set(xlabel="Store ID", ylabel='Total Customer Count', title='Jul-2018 to Jan-2019')

sns.barplot(x=['88', '237'], y=[total_transaction_count_store_88, len(df2[df2['STORE_NBR']=
ax1[2].set(xlabel="Store ID", ylabel='Total Transaction Count', title='Jul-2018 to Jan-2019

fig1.savefig('Task25.png')
```



In [28]:

```
import datetime

plt.figure(figsize=(15,8))

t_d1 = pre_trial_df[pre_trial_df['STORE_NBR'] == 88].groupby(by='MONTH').sum()
t_d1['Months'] = ['2019-1', '2018-7', '2018-8', '2018-9', '2018-10', '2018-11', '2018-12']
t_d1['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d1['Months']]

t_d2 = pre_trial_df[pre_trial_df['STORE_NBR'] == 237].groupby(by='MONTH').sum()
t_d2['Months'] = ['2019-1', '2018-7', '2018-8', '2018-9', '2018-10', '2018-11', '2018-12']
t_d2['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d2['Months']]

sns.lineplot(x=t_d1['Months'], y=t_d1['TOT_SALES'], legend='brief')
sns.lineplot(x=t_d2['Months'], y=t_d2['TOT_SALES'], legend='brief')

plt.legend(['Store No. 88', 'Store No. 237'])

fig1.savefig('Task26.png')
```



Results:

We got 2 most similar stores (ie. store 58 and 237) as control store for 88. Both 58 and 237 are quite similar, but 237 more similar to Store Id 88 than 53.

Therefore we select 237 as control store for Store id 88.

Final Results for Part-1 :-

1. Control store for 77 is 233

2. Control store for 86 is 155

3. Control store for 88 is 237

Part-2

Compare the Trial stores and Control stores under Trial period

In [29]:

```
feb_start_date = '2019-02-01'
apr_last_date = '2019-04-30'

msk = ((df['DATE'] >= feb_start_date) & (df['DATE'] <= apr_last_date))
trial_df = df[msk]
trial_df.head()
```

Out[29]:

	DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY	T
3	2019-03-09	1	1307	347	54	CCs Original	1	
11	2019-03-05	4	4074	2981	51	Doritos Mexicana	2	
15	2019-04-07	4	4149	3332	87	Infuzions BBQ Rib Prawn Crackers	2	
31	2019-04-17	7	7150	6904	114	Kettle Sensations Siracha Lime	2	
35	2019-03-02	7	7215	7174	114	Kettle Sensations Siracha Lime	2	

In [30]:

```
trial_df['MONTH'].unique()
```

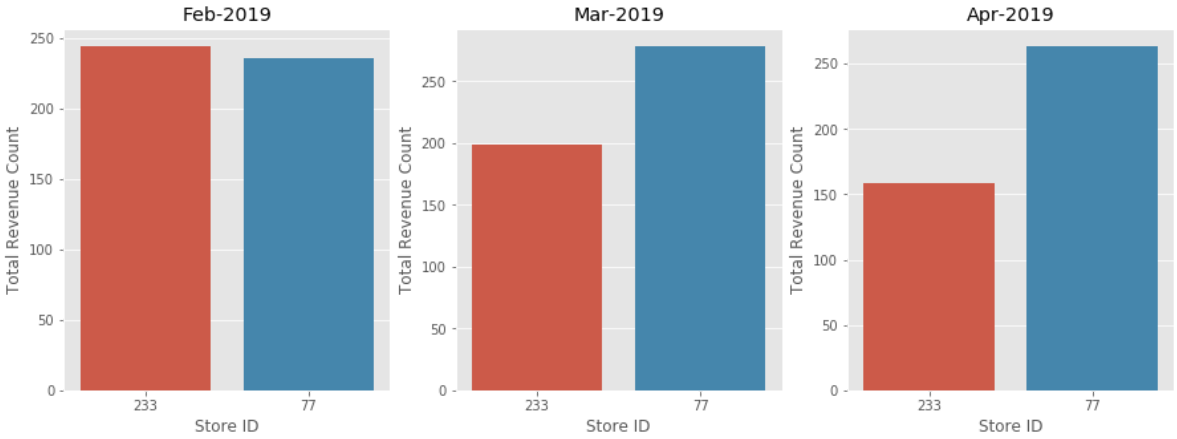
Out[30]:

```
array(['03', '04', '02'], dtype=object)
```

a) Compare the Trial store 77 and Control store 233.

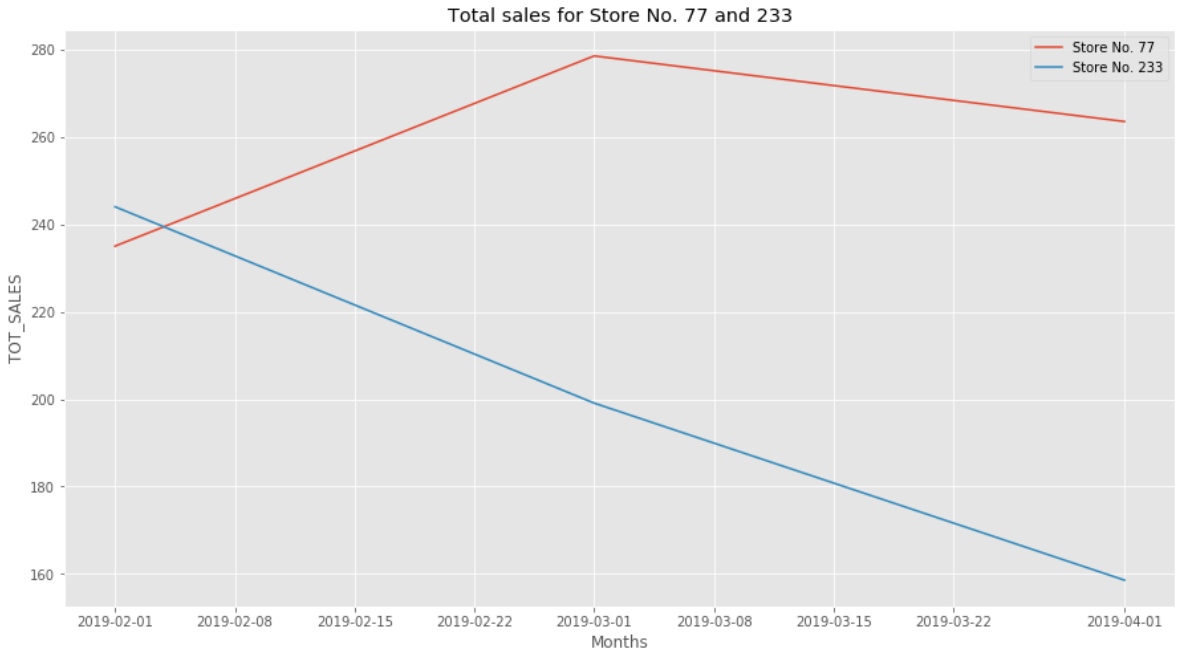
In [31]:

```
# <<<--- Plot the Data for Store 77 and 233 --->>>

fig1, ax1 =plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.barplot(x=['77', '233'], y=[trial_df[(trial_df['STORE_NBR']==77) & (trial_df['MONTH']==
ax1[0].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Feb-2019')

sns.barplot(x=['77', '233'], y=[trial_df[(trial_df['STORE_NBR']==77) & (trial_df['MONTH']==
ax1[1].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Mar-2019')

sns.barplot(x=['77', '233'], y=[trial_df[(trial_df['STORE_NBR']==77) & (trial_df['MONTH']==
ax1[2].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Apr-2019')

fig1.savefig('Task27.png')
```



In [32]:

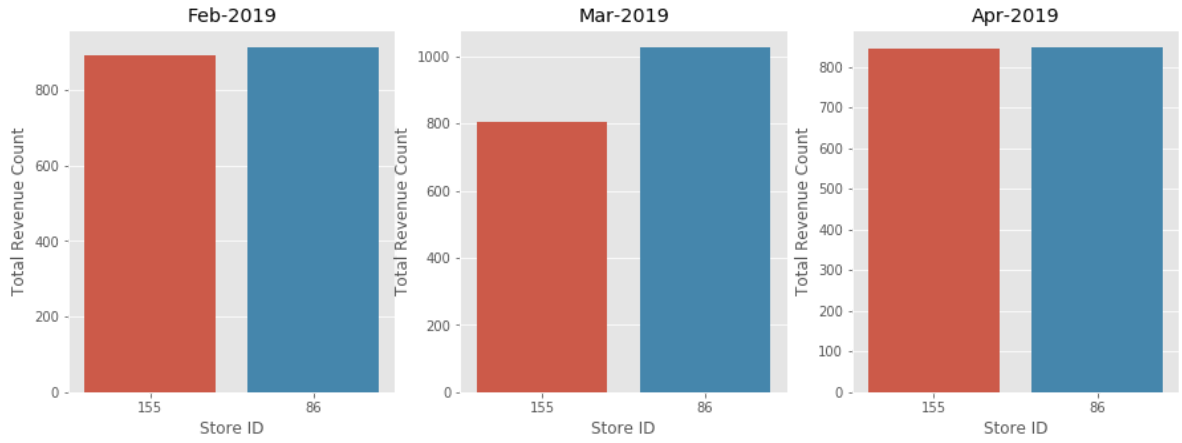
```
import datetime

plt.figure(figsize=(15,8))

t_d1 = trial_df[trial_df['STORE_NBR'] == 77].groupby(by='MONTH').sum()
t_d1['Months'] = ['2019-2', '2019-3', '2019-4']
t_d1['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d1['Months']]

t_d2 = trial_df[trial_df['STORE_NBR'] == 233].groupby(by='MONTH').sum()
t_d2['Months'] = ['2019-2', '2019-3', '2019-4']
t_d2['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d2['Months']]

sns.lineplot(x=t_d1['Months'], y=t_d1['TOT_SALES'], legend='brief')
sns.lineplot(x=t_d2['Months'], y=t_d2['TOT_SALES'], legend='brief')

plt.legend(['Store No. 77', 'Store No. 233'])
plt.title('Total sales for Store No. 77 and 233')

fig1.savefig('Task28.png')
```



b) Compare the Trial store 86 and Control store 155.

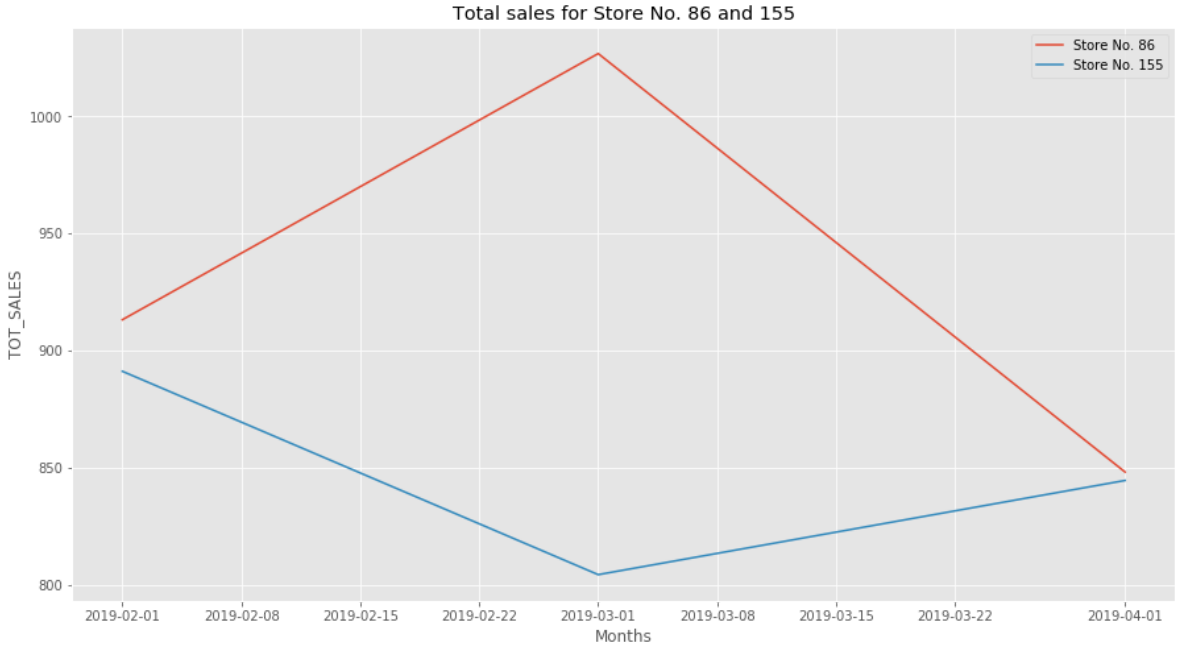
In [33]:

```
# <<<--- Plot the Data for Store 86 and 155 --->>>

fig1, ax1 =plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.barplot(x=['86', '155'], y=[trial_df[(trial_df['STORE_NBR']==86) & (trial_df['MONTH']==
ax1[0].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Feb-2019')
sns.barplot(x=['86', '155'], y=[trial_df[(trial_df['STORE_NBR']==86) & (trial_df['MONTH']==
ax1[1].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Mar-2019')

sns.barplot(x=['86', '155'], y=[trial_df[(trial_df['STORE_NBR']==86) & (trial_df['MONTH']==
ax1[2].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Apr-2019')

fig1.savefig('Task29.png')
```



In [34]:

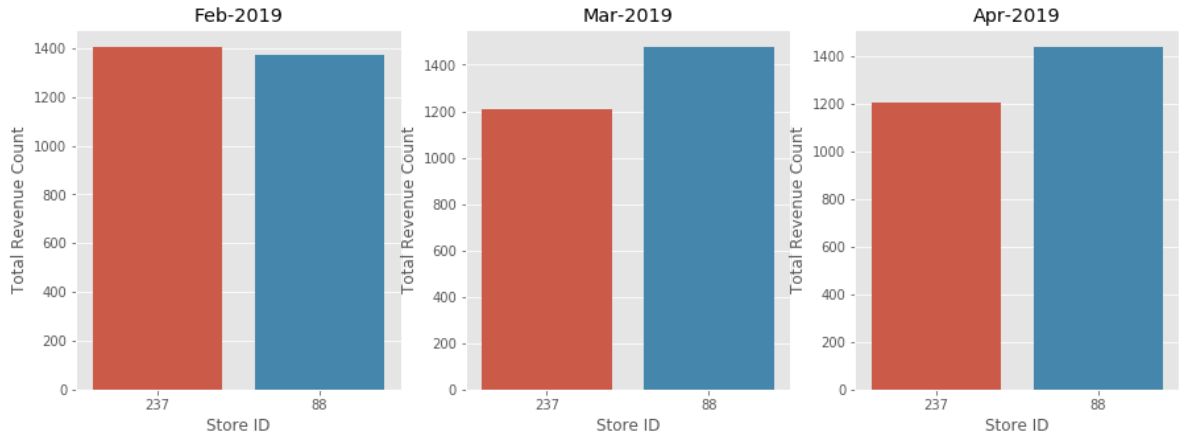
```
import datetime

plt.figure(figsize=(15,8))

t_d1 = trial_df[trial_df['STORE_NBR'] == 86].groupby(by='MONTH').sum()
t_d1['Months'] = ['2019-2', '2019-3', '2019-4']
t_d1['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d1['Months']]

t_d2 = trial_df[trial_df['STORE_NBR'] == 155].groupby(by='MONTH').sum()
t_d2['Months'] = ['2019-2', '2019-3', '2019-4']
t_d2['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d2['Months']]

sns.lineplot(x=t_d1['Months'], y=t_d1['TOT_SALES'], legend='brief')
sns.lineplot(x=t_d2['Months'], y=t_d2['TOT_SALES'], legend='brief')

plt.legend(['Store No. 86', 'Store No. 155'])
plt.title('Total sales for Store No. 86 and 155')

fig1.savefig('Task30.png')
```



c) Compare the Trial store 88 and Control store 237.

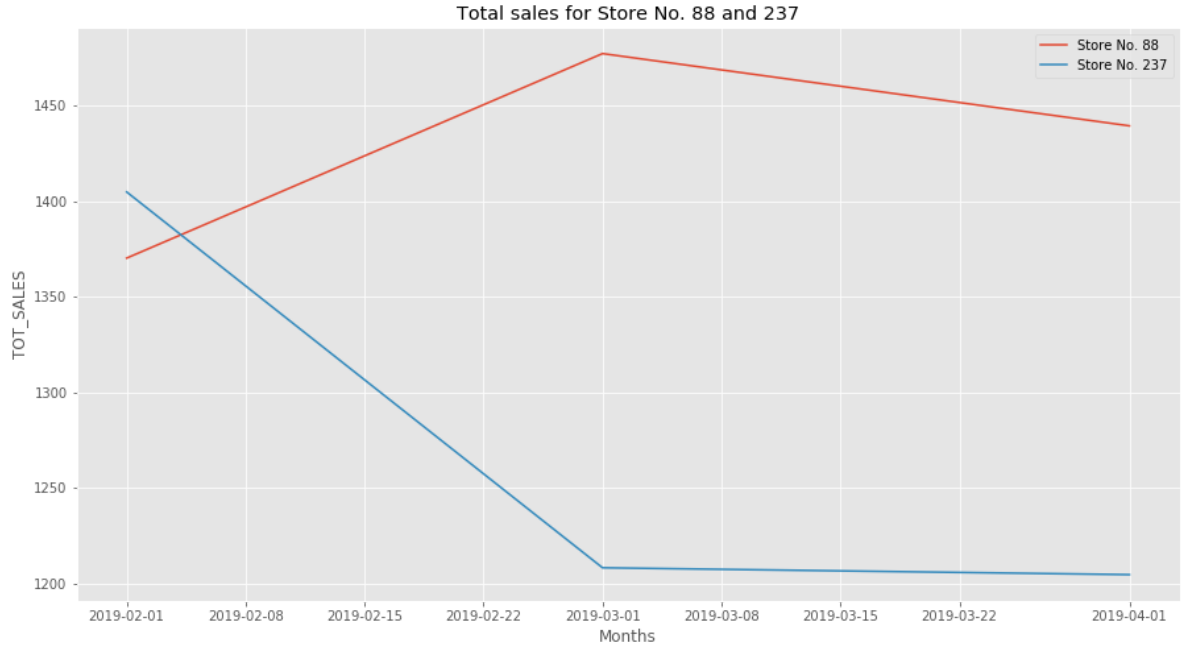
In [35]:

```
# <<<--- Plot the Data for Store 88 and 237 --->>>

fig1, ax1 =plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.barplot(x=['88', '237'], y=[trial_df[(trial_df['STORE_NBR']==88) & (trial_df['MONTH']==
ax1[0].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Feb-2019')
sns.barplot(x=['88', '237'], y=[trial_df[(trial_df['STORE_NBR']==88) & (trial_df['MONTH']==
ax1[1].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Mar-2019')

sns.barplot(x=['88', '237'], y=[trial_df[(trial_df['STORE_NBR']==88) & (trial_df['MONTH']==
ax1[2].set(xlabel="Store ID", ylabel='Total Revenue Count', title='Apr-2019')

fig1.savefig('Task31.png')
```



In [36]:

```
import datetime

plt.figure(figsize=(15,8))

t_d1 = trial_df[trial_df['STORE_NBR'] == 88].groupby(by='MONTH').sum()
t_d1['Months'] = ['2019-2', '2019-3', '2019-4']
t_d1['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d1['Months']]

t_d2 = trial_df[trial_df['STORE_NBR'] == 237].groupby(by='MONTH').sum()
t_d2['Months'] = ['2019-2', '2019-3', '2019-4']
t_d2['Months'] = [datetime.datetime.strptime(date, '%Y-%m') for date in t_d2['Months']]

sns.lineplot(x=t_d1['Months'], y=t_d1['TOT_SALES'], legend='brief')
sns.lineplot(x=t_d2['Months'], y=t_d2['TOT_SALES'], legend='brief')

plt.legend(['Store No. 88', 'Store No. 237'])
plt.title('Total sales for Store No. 88 and 237')

fig1.savefig('Task32.png')
```



Final Results for Part-2

1. Sales in Feburary-2019 for store number 77 is approx. same as its control store 233, but there is significant increase in sales in Store Numeber 77 in month March-2019 and April-2019 where as Store 233 shows us decrease in sales. Therefore we can say that changes made in Store 77 are effective.

2. Sales in Feburary-2019 for store number 86 is approx. same as its control store 155 and in next month (March-2019) sales for Store 86 increases abruptly than store 155, but in next month (April-2019) again the sales of both the stores becomes approximately equal. So we conclude that store number 86 is not showing us the significant changes and hence we say that changes made in Store 86 is not so effective like other trial stores.

3. Sales in Feburary-2019 for store number 88 is approx. same as its control store 237, but there is significant increase in sales in Store Numeber 88 in month March-2019 and April-2019 where as Store 237 shows us decrease in sales. Therefore we can say that changes made in Store 88 are effective.

Overall Summary

We've found control stores 233, 155, 237 for trial stores 77, 86 and 88 respectively.

The trial stores 77 and 88 during the trial period show a significant difference after one month from starting of trial period. But Store 86 does not show us significant change.