Part_I_exploration_template

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1 Part I - Ford GoBike Tripdata

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1.2 Ford GoBike Program

1.3 Data Analysis

1.4 Introduction

This datast contains 183,412 records of bike trips on the San Francisco city in California.
Was launched on August 2013 and has 4618 bikes in 329 stations. It contains information of just 1 month, which is February 2019. The pricing information is not in the dataset but was pulled from wikipedia, this can give context to understand better the data.

Fares:

Single rides start at 3 usd.
Day passes are: 10 usd.
Month membership is: 25 usd.
Year membership is: 159 usd.

Times:

Single ride or day pass 30 min (1800 seconds)
Full price members 45 min. (2700 seconds)
Each additional 15 min cost 3 usd extra (2 usd for members).

1.5 Preliminary Wrangling

```
In [1]: # import all packages and set plots to be embedded inline
        import numpy as np
        import pandas as pd
        import matplotlib.pyplot as plt
        import seaborn as sb
        from markupsafe import escape
        import warnings
        warnings.filterwarnings("ignore")

        %matplotlib inline

In [2]: df = pd.read_csv('fordgobike-tripdata.csv', parse_dates=True)
```

```
In [3]: # Look for missing values, columns, data types
        df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 183412 entries, 0 to 183411
Data columns (total 16 columns):
duration_sec               183412 non-null int64
start_time                 183412 non-null object
end_time                   183412 non-null object
start_station_id           183215 non-null float64
start_station_name         183215 non-null object
start_station_latitude     183412 non-null float64
start_station_longitude    183412 non-null float64
end_station_id             183215 non-null float64
end_station_name           183215 non-null object
end_station_latitude       183412 non-null float64
end_station_longitude      183412 non-null float64
bike_id                    183412 non-null int64
user_type                  183412 non-null object
member_birth_year          175147 non-null float64
member_gender              175147 non-null object
bike_share_for_all_trip    183412 non-null object
dtypes: float64(7), int64(2), object(7)
memory usage: 22.4+ MB
```

```
In [4]: # Look at a data sample to see its structure and contents
        df.head(5)
```

Out[4]:

	duration_sec	start_time	end_time	\
0	52185	2019-02-28 17:32:10.1450	2019-03-01 08:01:55.9750	
1	42521	2019-02-28 18:53:21.7890	2019-03-01 06:42:03.0560	
2	61854	2019-02-28 12:13:13.2180	2019-03-01 05:24:08.1460	
3	36490	2019-02-28 17:54:26.0100	2019-03-01 04:02:36.8420	
4	1585	2019-02-28 23:54:18.5490	2019-03-01 00:20:44.0740	

	start_station_id	start_station_name	\
0	21.0	Montgomery St BART Station (Market St at 2nd St)	
1	23.0	The Embarcadero at Steuart St	
2	86.0	Market St at Dolores St	
3	375.0	Grove St at Masonic Ave	
4	7.0	Frank H Ogawa Plaza	

	start_station_latitude	start_station_longitude	end_station_id	\
0	37.789625	-122.400811	13.0	
1	37.791464	-122.391034	81.0	
2	37.769305	-122.426826	3.0	
3	37.774836	-122.446546	70.0	

```
4               37.804562              -122.271738           222.0

                                end_station_name  end_station_latitude  \
0                Commercial St at Montgomery St             37.794231
1                             Berry St at 4th St             37.775880
2  Powell St BART Station (Market St at 4th St)             37.786375
3                         Central Ave at Fell St             37.773311
4                          10th Ave at E 15th St             37.792714

   end_station_longitude  bike_id   user_type  member_birth_year  \
0            -122.402923     4902    Customer             1984.0
1            -122.393170     2535    Customer                NaN
2            -122.404904     5905    Customer             1972.0
3            -122.444293     6638  Subscriber             1989.0
4            -122.248780     4898  Subscriber             1974.0

  member_gender bike_share_for_all_trip
0          Male                     No
1           NaN                     No
2          Male                     No
3         Other                     No
4          Male                    Yes
```

In [5]:
```
# Look at the values and see if there is innacurate/wrong data
df.describe()
```

Out[5]:
```
         duration_sec  start_station_id  start_station_latitude  \
count  183412.000000     183215.000000           183412.000000
mean      726.078435        138.590427               37.771223
std      1794.389780        111.778864                0.099581
min        61.000000          3.000000               37.317298
25%       325.000000         47.000000               37.770083
50%       514.000000        104.000000               37.780760
75%       796.000000        239.000000               37.797280
max     85444.000000        398.000000               37.880222

       start_station_longitude  end_station_id  end_station_latitude  \
count            183412.000000   183215.000000         183412.000000
mean               -122.352664      136.249123             37.771427
std                   0.117097      111.515131              0.099490
min                -122.453704        3.000000             37.317298
25%                -122.412408       44.000000             37.770407
50%                -122.398285      100.000000             37.781010
75%                -122.286533      235.000000             37.797320
max                -121.874119      398.000000             37.880222

       end_station_longitude        bike_id  member_birth_year
count          183412.000000  183412.000000      175147.000000
```

mean	-122.352250	4472.906375	1984.806437
std	0.116673	1664.383394	10.116689
min	-122.453704	11.000000	1878.000000
25%	-122.411726	3777.000000	1980.000000
50%	-122.398279	4958.000000	1987.000000
75%	-122.288045	5502.000000	1992.000000
max	-121.874119	6645.000000	2001.000000

No negative durations. The max duration is slightly less that 24 hours, makes sense for someone with a day pass.
Birth year has a minimum of 1878, for sure a mistake.

2 Assesment

2.1 Quality issues

100. There is missing information on station ids.

101. `member_birth_year` contains numbers of people bon in 1800s, the oldest living person was born in 1903.

2.2 Tidyness issues

200 start time and end times are strings representing dates.
210 `bike_id` should be categorical and not quantitative.
220 `member_birth_year` should be int64 type.
230 `start_station_id` and `end_station_id` should be categorical and not quantitative.
240 There are 6 columns that should be on another table for stations alone:

`start_station_name`, `start_station_latitude`, `start_station_longitude`, `end_station_name`, `end_station_latitude`, `end_station_longitude`.

3 Cleaning

3.1 Quality issues

100. Remove form dataframe records with no `start_station_id`.
101. Replace birth years of members born before 1903.

3.2 Tidyness issues

200 Convert `start_time` & `end_time` columns to datetime64[ns].
210 `bike_id` should be categorical and not quantitative.
220 `member_birth_year` should be int64 type.
230 `start_station_id` and `end_station_id` should be categorical and not quantitative.
240 There are 6 columns that should be on another table for stations alone:

start_station_name, start_station_latitude, start_station_longitude, end_station_name, end_station_latitude, end_station_longitude.

```
In [6]: # Make a copy of the original dataframe to another one on which changes ae going to be m
        df_clean = df.copy()
```

3.2.1 Quality issue 100

Define
There are incomplete records rempresenting 0.1% of the data and are not relevant. Remove records without start_station_id.

```
In [7]: print('Number of total records is                          {}'.format(df_clean.shape[0]))
        print('Number of records with empty "start_station_id" is: {}'.format(df_clean[df_clean.
```

```
Number of total records is                          183412
Number of records with empty "start_station_id" is: 197
```

Code

```
In [8]: # filter records.
        df_clean = df_clean[~df_clean.start_station_id.isna()]
```

Test

```
In [9]: print('Number of total records is                          {}'.format(df_clean.shape[0]))
        print('Number of records with empty "start_station_id" is: {}'.format(df_clean[df_clean.
```

```
Number of total records is                          183215
Number of records with empty "start_station_id" is: 0
```

3.2.2 Quality issue 110

Define
Replace birth years of 1903 and below with 0.

```
In [10]: df_clean[df_clean.member_birth_year < 1903].shape[0]
```

```
Out[10]: 71
```

Code

```
In [11]: df_clean = df_clean[df_clean.member_birth_year >= 1903]
```

Test

```
In [12]: df_clean[df_clean.member_birth_year < 1903].shape[0]
```

```
Out[12]: 0
```

3.2.3 Tidyness issue 200

Define

`start_time` and `end_time` columns are strings, convert to DateTime.

```
In [13]: print('"start_time" column type: {}'.format(df_clean.start_time.dtype))
         print('"end_time"   column type  {}'.format(df_clean.end_time.dtype))
```

```
"start_time" column type: object
"end_time"   column type  object
```

Code

```
In [14]: df_clean.start_time = pd.to_datetime(df_clean.start_time)
         df_clean.end_time = pd.to_datetime(df_clean.end_time)
```

Test

```
In [15]: print('"start_time" column type: {}'.format(df_clean.start_time.dtype))
         print('"end_time"   column type  {}'.format(df_clean.end_time.dtype))
```

```
"start_time" column type: datetime64[ns]
"end_time"   column type  datetime64[ns]
```

```
In [16]: df_clean.head(1)
```

```
Out[16]:    duration_sec              start_time                end_time  \
         0         52185 2019-02-28 17:32:10.145 2019-03-01 08:01:55.975

            start_station_id                                start_station_name  \
         0              21.0  Montgomery St BART Station (Market St at 2nd St)

            start_station_latitude  start_station_longitude  end_station_id  \
         0               37.789625              -122.400811            13.0

                          end_station_name  end_station_latitude  \
         0  Commercial St at Montgomery St             37.794231

            end_station_longitude  bike_id user_type  member_birth_year member_gender  \
         0            -122.402923     4902  Customer             1984.0          Male

           bike_share_for_all_trip
         0                      No
```

3.2.4 Tydiness issue 210

Define

`bike_id` is a number but should not be treated like a number (cannot be summed for example). Convert it to categorical.

```
In [17]: print('"bike_id" column type: {}'.format(df_clean.bike_id.dtype))
```

```
"bike_id" column type: int64
```

```
In [18]: df_clean.bike_id.sum()
```

```
Out[18]: 783913534
```

Code

```
In [19]: df_clean.bike_id = pd.Categorical(df_clean.bike_id)
```

Test

```
In [20]: print('"bike_id" column type: {}'.format(df_clean.bike_id.dtype))
```

```
"bike_id" column type: category
```

3.2.5 Tydiness issue 220

Define
'member_birth_year' is of type float, change it to integer.

```
In [21]: print('"member_birth_year" column type: {}'.format(df_clean.member_birth_year.dtype))
```

```
"member_birth_year" column type: float64
```

```
In [22]: df_clean.head(1)
```

```
Out[22]:    duration_sec              start_time                end_time  \
         0         52185 2019-02-28 17:32:10.145 2019-03-01 08:01:55.975

            start_station_id                                start_station_name  \
         0              21.0  Montgomery St BART Station (Market St at 2nd St)

            start_station_latitude  start_station_longitude  end_station_id  \
         0               37.789625              -122.400811            13.0

                          end_station_name  end_station_latitude  \
         0  Commercial St at Montgomery St             37.794231

            end_station_longitude bike_id user_type  member_birth_year member_gender  \
         0            -122.402923    4902  Customer             1984.0          Male

           bike_share_for_all_trip
         0                      No
```

Code

```
In [23]: df_clean.member_birth_year.fillna(0, inplace=True)
         df_clean.member_birth_year = df_clean.member_birth_year.astype(np.int64)
```

Test

```
In [24]: print('"member_birth_year" column type: {}'.format(df_clean.member_birth_year.dtype))
```

```
"member_birth_year" column type: int64
```

```
In [25]: df_clean.head(1)
```

```
Out[25]:    duration_sec              start_time                end_time  \
         0         52185 2019-02-28 17:32:10.145 2019-03-01 08:01:55.975

            start_station_id                                start_station_name  \
         0              21.0  Montgomery St BART Station (Market St at 2nd St)

            start_station_latitude  start_station_longitude  end_station_id  \
         0               37.789625              -122.400811            13.0

                          end_station_name  end_station_latitude  \
         0  Commercial St at Montgomery St             37.794231

            end_station_longitude bike_id user_type  member_birth_year member_gender  \
         0            -122.402923    4902  Customer               1984          Male

           bike_share_for_all_trip
         0                      No
```

3.2.6 Tydiness issue 230

Define
Change `start_station_id` & `end_station_id` to integer and then categorical.

```
In [26]: print('"start_station_id" column type: {}'.format(df_clean.start_station_id.dtype))
         print('"end_station_id" column type:   {}'.format(df_clean.end_station_id.dtype))
```

```
"start_station_id" column type: float64
"end_station_id" column type:   float64
```

```
In [27]: df_clean.head(1)
```

```
Out[27]:    duration_sec              start_time                end_time  \
         0         52185 2019-02-28 17:32:10.145 2019-03-01 08:01:55.975

            start_station_id                                start_station_name  \
```

```
0              21.0  Montgomery St BART Station (Market St at 2nd St)

   start_station_latitude  start_station_longitude  end_station_id  \
0               37.789625              -122.400811            13.0

                 end_station_name  end_station_latitude  \
0  Commercial St at Montgomery St             37.794231

   end_station_longitude bike_id user_type  member_birth_year member_gender  \
0            -122.402923    4902  Customer               1984          Male

  bike_share_for_all_trip
0                      No
```

Code

```
In [28]: df_clean.start_station_id = df_clean.start_station_id.astype(np.int64)
         df_clean.end_station_id = df_clean.end_station_id.astype(np.int64)

In [29]: df_clean.start_station_id = pd.Categorical(df_clean.start_station_id)
         df_clean.end_station_id = pd.Categorical(df_clean.end_station_id)
```

Test

```
In [30]: print('"start_station_id" column type: {}'.format(df_clean.start_station_id.dtype))
         print('"end_station_id" column type:   {}'.format(df_clean.end_station_id.dtype))

"start_station_id" column type: category
"end_station_id" column type:   category


In [31]: df_clean.head(1)

Out[31]:    duration_sec              start_time                end_time  \
         0         52185 2019-02-28 17:32:10.145 2019-03-01 08:01:55.975

           start_station_id                                start_station_name  \
         0               21  Montgomery St BART Station (Market St at 2nd St)

            start_station_latitude  start_station_longitude end_station_id  \
         0               37.789625              -122.400811             13

                          end_station_name  end_station_latitude  \
         0  Commercial St at Montgomery St             37.794231

            end_station_longitude bike_id user_type  member_birth_year member_gender  \
         0            -122.402923    4902  Customer               1984          Male

           bike_share_for_all_trip
         0                      No
```

3.2.7 Tydiness issue 240

Define

The dataframe contains information types that should be separated, first a dataframjust for the stations should be created and contain the columns: `station_id`, `name`, `latitude`, `longitude`.
Start and end stations share the names and IDs, and there are no extra stations in one set that the other does not contain (the unique value are the same).
After that drop this columns from the df_clean dataframe: - `start_station_name` - `start_station_latitude` - `start_station_longitude` - `end_station_name` - `end_station_latitude` - `end_station_longitude`

```
In [32]: df_clean.columns
```

```
Out[32]: Index(['duration_sec', 'start_time', 'end_time', 'start_station_id',
                'start_station_name', 'start_station_latitude',
                'start_station_longitude', 'end_station_id', 'end_station_name',
                'end_station_latitude', 'end_station_longitude', 'bike_id', 'user_type',
                'member_birth_year', 'member_gender', 'bike_share_for_all_trip'],
               dtype='object')
```

Code

```
In [33]: df_stations = df_clean.copy()
         column_names = {'start_station_id': 'id',
                         'start_station_name': 'name',
                         'start_station_latitude': 'latitude',
                         'start_station_longitude': 'longitude'}
         df_stations = df_stations[['start_station_id','start_station_name','start_station_latit
         df_stations.rename(columns=column_names, inplace=True)
         df_stations.drop_duplicates(inplace=True)
```

```
In [34]: col_list = ['start_station_name', 'start_station_latitude', 'start_station_longitude',
                     'end_station_name', 'end_station_latitude', 'end_station_longitude']
         df_clean.drop(col_list,axis=1, inplace=True)
```

Test

```
In [35]: df_clean.columns
```

```
Out[35]: Index(['duration_sec', 'start_time', 'end_time', 'start_station_id',
                'end_station_id', 'bike_id', 'user_type', 'member_birth_year',
                'member_gender', 'bike_share_for_all_trip'],
               dtype='object')
```

```
In [36]: df_stations.head()
```

```
Out[36]:     id                                              name   latitude  \
         0   21  Montgomery St BART Station (Market St at 2nd St)  37.789625
         2   86                          Market St at Dolores St  37.769305
         3  375                          Grove St at Masonic Ave  37.774836
```

```
4    7                              Frank H Ogawa Plaza  37.804562
5   93                        4th St at Mission Bay Blvd S  37.770407

    longitude
0 -122.400811
2 -122.426826
3 -122.446546
4 -122.271738
5 -122.391198
```

4 Store

```
In [37]: df_clean.to_csv('fordgobike-tripdata-clean.csv')
         df_stations.to_csv('fordgobike-stations.csv')
```

4.0.1 Structure of your dataset

The dataset after cleaning has 2 tables or dataframes.

```
<th style="text-align:left">Column Name</th>
<th style="text-align:left">Description</th>

<td style="text-align:left"><b>duration_sec</b></td>
<td style="text-align:left">Bike ride duration in seconds.</td>

<td style="text-align:left"><b>start_time</b></td>
<td style="text-align:left">Time at the ride started.</td>

<td style="text-align:left"><b>end_time</b></td>
<td style="text-align:left">Time at the ride ended.</td>

<td style="text-align:left"><b>start_station_id</b></td>
<td style="text-align:left">Id of the station where the ride started.</td>

<td style="text-align:left"><b>end_station_id</b></td>
<td style="text-align:left">Id of the station where the ride ended.</td>

<td style="text-align:left"><b>bike_id</b></td>
<td style="text-align:left">Id of the bike used for the trip.</td>

<td style="text-align:left"><b>user_type</b></td>
<td style="text-align:left">Can be Customer or subscriber</td>

<td style="text-align:left"><b>member_birth_year</b></td>
<td style="text-align:left">Id of the station where the ride ended.</td>

<td style="text-align:left"><b>member_gender</b></td>
<td style="text-align:left">Can be Male, Female or Other, also can be blank.</td>
```

```
<td style="text-align:left"><b>bike_share_for_all_trip</b></td>
<td style="text-align:left">Id of the station where the ride ended .</td>
```

```
<tr>
    <th style="text-align:left">Column name</th>
    <th style="text-align:left">Description</th>
</tr>
<tr>
    <td style="text-align:left">id</td>
    <td style="text-align:left">Integer representing a station.</td>
</tr>
<tr>
    <td style="text-align:left">name</td>
    <td style="text-align:left">Name of the station, street and number or streets crossing.</td>
</tr>
<tr>
    <td style="text-align:left">latitude</td>
    <td style="text-align:left">Float representing latitude coordinate of the station.</td>
</tr>
<tr>
    <td style="text-align:left">longitude</td>
    <td style="text-align:left">Float representing longitude coordinate of the station.</td>
</tr>
```

4.0.2 Main features of interest in the dataset

1. Who uses the service more.
2. When are rides more active.
3. Where do the bikes go more often.
4. How much tome do the rides last.

4.0.3 What features in the dataset will help support the investigation into the feature(s) of interest?

Duration, birth years, station location, gender.

4.1 Univariate Exploration

4.1.1 Questions about tIme.

1. How is the ride time distributed?
2. Do users stick to the normal ride time or they pay extra?

4.1.2 Visualization

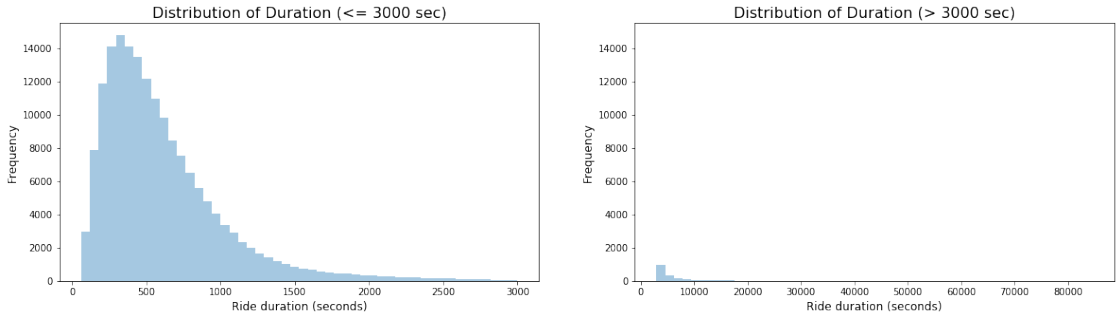
```
In [38]: print('Rides with more than 3000 second duration: {}'.format(df_clean[df_clean.duration
         print('Rides with less than 3000 second duration: {}'.format(df_clean[df_clean.duration
```

```
Rides with more than 3000 second duration: 1924
Rides with less than 3000 second duration: 172957
```

In [39]:
```
# Ride duration distibution
# Since there are some outliers on the uper side decided to make 2 graphs to have a cle
# of the rides

# Distribution of rides with less or equal than 3000sec duration
fig = plt.figure(figsize = [20, 5])
plt.subplot(1, 2, 1)
g1 = sb.distplot(df_clean[df_clean.duration_sec <= 3000].duration_sec, kde=False);
g1.set_title("Distribution of Duration (<= 3000 sec)", fontsize=16)
g1.set_ylabel('Frequency', fontsize=12)
g1.set_xlabel('Ride duration (seconds)', fontsize=12)
y_min, y_max = g1.get_ylim();

# Distribution of rides with less or equal than 3000sec duration
g2 = plt.subplot(1, 2, 2)
sb.distplot(df_clean[df_clean.duration_sec > 3000].duration_sec, kde=False);
g2.set_title("Distribution of Duration (> 3000 sec)", fontsize=16)
g2.set_ylabel('Frequency', fontsize=12)
g2.set_xlabel('Ride duration (seconds)', fontsize=12)
g2.set_ylim(y_min, y_max);
```

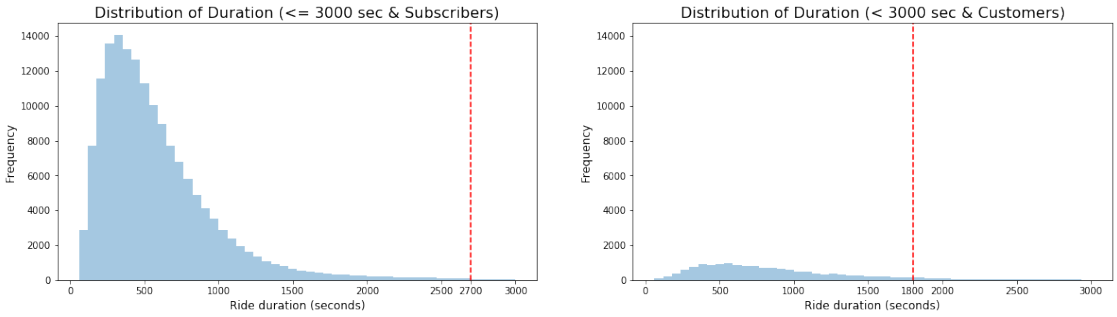


In [40]:
```
# Users sticking to one standard ride duration behavior.

# Distribution of rides with less or equal than 3000sec duration
fig = plt.figure(figsize = [20, 5])
plt.subplot(1, 2, 1)
subSet1 = df_clean[(df_clean.duration_sec <= 3000) & (df_clean.user_type == 'Subscriber
g1 = sb.distplot(subSet1, kde=False);
g1.set_title("Distribution of Duration (<= 3000 sec & Subscribers)", fontsize=16)
g1.set_ylabel('Frequency', fontsize=12)
g1.set_xlabel('Ride duration (seconds)', fontsize=12)
```

```
g1.axvline(x=2700, color='r', linestyle='--')
# g1.annotate('2700', xy=(2700, 8000), xytext=(2800, 8000), arrowprops=dict(arrowstyle=
y_min, y_max = g1.get_ylim();
g1xtick_list = g1.get_xticks().tolist()
g1xtick_list.append(2700)
g1xtick_list.sort()
g1.set_xticks(g1xtick_list[1:-1])

# Distribution of rides with less or equal than 3000sec duration
g2 = plt.subplot(1, 2, 2)
subSet2 = subSet1 = df_clean[(df_clean.duration_sec <= 3000) & (df_clean.user_type == '
sb.distplot(subSet2, kde=False);
g2.set_title("Distribution of Duration (< 3000 sec & Customers)", fontsize=16)
g2.set_ylabel('Frequency', fontsize=12)
g2.set_xlabel('Ride duration (seconds)', fontsize=12)
g2.axvline(x=1800, color='r', linestyle='--')
g2.set_ylim(y_min, y_max);
g2xtick_list = g2.get_xticks().tolist()
g2xtick_list.append(1800)
g2xtick_list.sort()
g2.set_xticks(g2xtick_list[1:-1]);
```



In [41]:
```
# Proportion of subscribers not exceeding the rent time
subs_ride_below_2700 = df_clean[(df_clean.user_type == 'Subscriber') & (df_clean.durati
                                df_clean[df_clean.user_type == 'Subscriber'].shape[0]
cust_ride_below_1800 = df_clean[(df_clean.user_type == 'Customer') & (df_clean.duration
                                df_clean[df_clean.user_type == 'Customer'].shape[0]
subscribers_rides_below_2700 = df_clean[(df_clean.user_type == 'Subscriber') & (df_clea
customers_rides_below_1800 = df_clean[(df_clean.user_type == 'Customer') & (df_clean.du

print('Proportion of subscribers below 2700 seconds:{}'.format(subs_ride_below_2700))
print('Proportion of customers   below 1800 seconds:{}'.format(cust_ride_below_1800))
print('Mean ride for subscribers below 2700 seconds:{}'.format(subscribers_rides_below_
print('Mean ride for customers   below 1800 seconds:{}'.format(customers_rides_below_18
```

```
Proportion of subscribers below 2700 seconds:0.991700353713997
Proportion of customers   below 1800 seconds:0.8831592295151259
```

```
Mean ride for subscribers below 2700 seconds:580.1739806122059
Mean ride for customers   below 1800 seconds:776.4394229454397
```

4.1.3 Answer

1. We can see that the ride duration time is highly skewed to the right.
2. We can see on the charts that for subscribers they almost never exceed the time, less than 1%. And for Customers group sligthly more than 11%, this and the volume of rides suggest that this group are visitors / tourists, not regular users.

3. Rides last on average 9.6min for 99% of Subscribers and 13min for 88% of Customers.

4.1.4 Distribution(s) of the variable(s) of interest.

Data has an nimodal distribution skewed to the right, there are afew outliers on the high side but represent about 2% of the total dataset.
No transformations used.

4.1.5 Operations on the data to tidy, adjust, or change the form of the data.

The data was reestructured, the station info was separated from the ride info to complply with each **type** of observational unit is a table. Data types were changed, start and end times change to datetime, birth year changed to integer and some other changes stated on the assesment.

4.2 Bivariate Exploration

4.2.1 Question

Among the users who uses the service de most? male, females?.

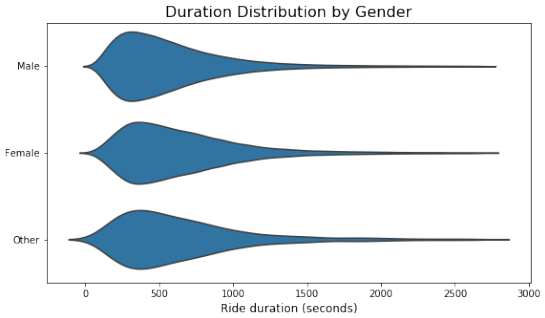
4.2.2 Visualization

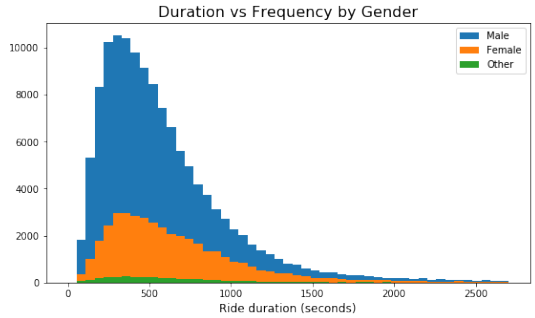
```
In [42]: subSet = df_clean[df_clean.duration_sec < 2700]

         fig = plt.figure(figsize = [20, 5])
         plt.subplot(1, 2, 1)
         sb.violinplot(data=subSet, y='member_gender', x='duration_sec', color=sb.color_palette(
         plt.title('Duration Distribution by Gender', fontsize=16);
         plt.ylabel('')
         plt.xlabel('Ride duration (seconds)', fontsize=12)

         plt.subplot(1, 2, 2)
         bins = np.linspace(0,2700,50)
         plt.hist(subSet[subSet.member_gender == 'Male'].duration_sec, bins=bins, label='Male');
         plt.hist(subSet[subSet.member_gender == 'Female'].duration_sec, bins=bins, label='Male'
         plt.hist(subSet[subSet.member_gender == 'Other'].duration_sec, bins=bins, label='Male')
         plt.legend(subSet.member_gender.unique());
```

```
plt.xlabel('Ride duration (seconds)', fontsize=12)
plt.title('Duration vs Frequency by Gender', fontsize=16);
```





4.2.3 Answer

We can see the beahvior or type of usage is about the same looking at the violin plot, but on the histogram we can see that **the vast majority of users is male**.

4.2.4 How did the feature(s) of interest vary with other features in the dataset?

I can see that the most active users are male, and that the usage pattern is similar among genders.

4.3 Multivariate Exploration

4.3.1 Questions

How do ages are related to BikeGo usage?

4.3.2 Visualization

```
In [43]: # Define a function to calculate age of the user
         def get_age(x):
             """
             Function to calculate the age of the user based on the birth year
             Input  x - integer   Birthyear of the user
             Output age - integer Age calculated from 2019 year
             """
             age = 2019 - x
             return age
```

```
In [44]: df_clean['age'] = df_clean.member_birth_year
         df_clean['age'] = df_clean.age.apply(get_age)
         df_clean.head()
```

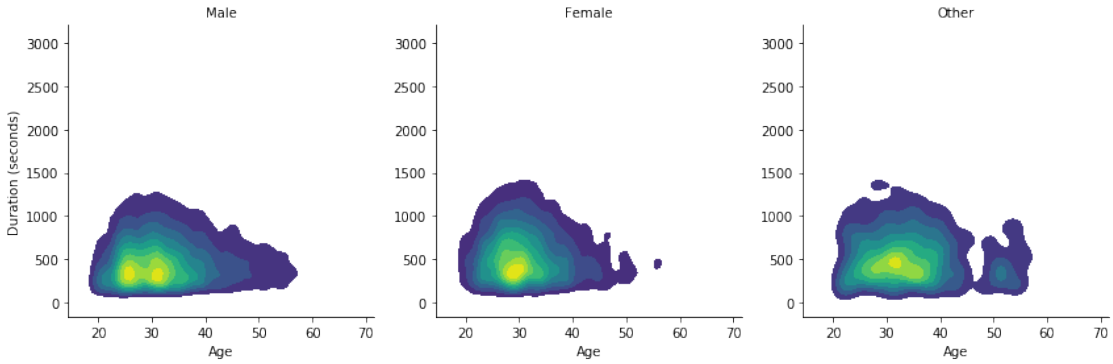
```
Out[44]:    duration_sec              start_time                end_time  \
         0         52185 2019-02-28 17:32:10.145 2019-03-01 08:01:55.975
```

```
2          61854 2019-02-28 12:13:13.218 2019-03-01 05:24:08.146
3          36490 2019-02-28 17:54:26.010 2019-03-01 04:02:36.842
4           1585 2019-02-28 23:54:18.549 2019-03-01 00:20:44.074
5           1793 2019-02-28 23:49:58.632 2019-03-01 00:19:51.760

  start_station_id end_station_id bike_id   user_type  member_birth_year  \
0               21             13    4902    Customer               1984
2               86              3    5905    Customer               1972
3              375             70    6638  Subscriber               1989
4                7            222    4898  Subscriber               1974
5               93            323    5200  Subscriber               1959

  member_gender bike_share_for_all_trip  age
0          Male                     No   35
2          Male                     No   47
3         Other                     No   30
4          Male                    Yes   45
5          Male                     No   60
```

In [45]:
```
# Plot the Seaborn's FacetGrid
df_clean_subset = df_clean[(df_clean.duration_sec < 3000) & (df_clean.member_birth_year
g = sb.FacetGrid(data = df_clean_subset, size=4, col = 'member_gender');
g.map(sb.kdeplot, 'age', 'duration_sec', shade=True, cmap = 'viridis', shade_lowest = F
g.set_ylabels('Duration (seconds)');
g.set_xlabels('Age');
g.set_titles('{col_name}');
```



In [46]:
```
# Most repeating age for riders
print('Most common Male age:  {}'.format(df_clean_subset[df_clean_subset.member_gender
print('Most common Female age:{}'.format(df_clean_subset[df_clean_subset.member_gender
print('Most common Other age: {}'.format(df_clean_subset[df_clean_subset.member_gender
```

```
Most common Male age:  31
Most common Female age:29
Most common Other age: 36
```

4.3.3 Answer

Most of the users are around 30 years old at the time the data was sampled. Also the data is concentrated below 25min ride duration.

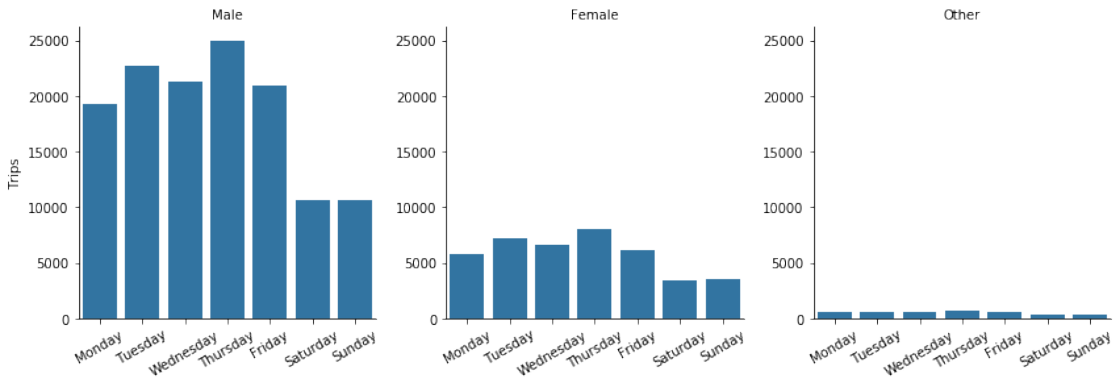
4.3.4 Question

What are the days with more rides?

4.3.5 Visual

```
In [47]: df_clean['dow'] = df_clean.start_time.dt.dayofweek
         df_clean['day_name'] = df_clean.start_time.dt.day_name()
```

```
In [48]: # Plot the Seaborn's FacetGrid
         subSet = df_clean.groupby(['member_gender','dow','day_name']).count().reset_index()
         g = sb.FacetGrid(data = subSet, size=4, col = 'member_gender', col_order=['Male','Femal
         g.map(sb.barplot, 'dow', 'duration_sec');
         g.set_ylabels('Trips');
         g.set_xlabels('')
         weekdays = ['Monday','Tuesday','Wednesday','Thursday','Friday','Saturday','Sunday']
         g.set_xticklabels(weekdays, rotation=30)
         g.set_titles('{col_name}');
```




```
In [64]: rides_on_wkdays = df_clean[df_clean.day_name.str.contains('Monday|Tuesday|Wednesday|Thu
         rides_on_wkends = df_clean[df_clean.day_name.str.contains('Saturday|Sunday')]

         print_statements = {'Average rides on weekdays:': rides_on_wkdays.shape[0] / (5*4),
                             'Average rides on weekends:': rides_on_wkends.shape[0] / (2*4)}

         for key, value in print_statements.items():
             print(key, value)
```

```
Average rides on weekdays: 7298.3
Average rides on weekends: 3614.375
```

4.3.6 Answer

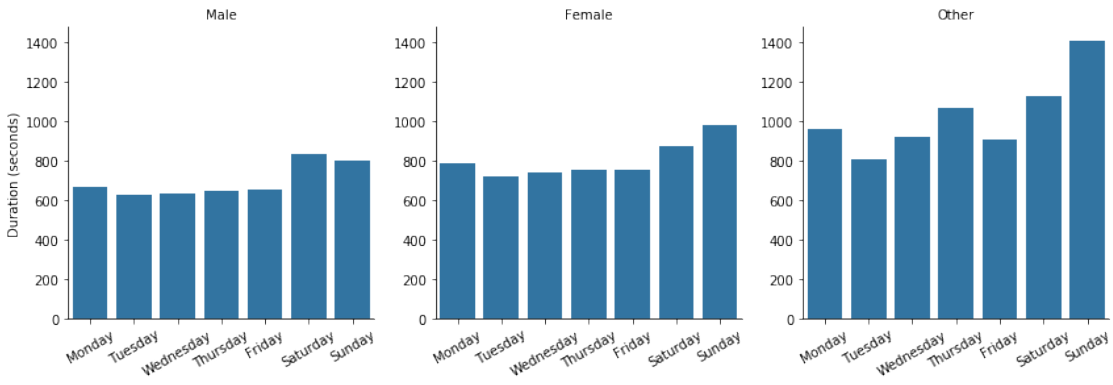
The number of rides is more elevated on weekdays.

4.3.7 Question

Does the trip time changes over the week?

4.3.8 Visual

```
In [50]: # Plot the Seaborn's FacetGrid
         subSet = df_clean.groupby(['member_gender','dow','day_name']).mean().reset_index()
         g = sb.FacetGrid(data = subSet, size=4, col = 'member_gender', col_order=['Male','Femal
         g.map(sb.barplot, 'dow', 'duration_sec');
         g.set_ylabels('Duration (seconds)');
         g.set_xlabels('')
         g.set_xticklabels(['Monday','Tuesday','Wednesday','Thursday','Friday','Saturday','Sunda
         g.set_titles('{col_name}');
```



4.3.9 Answer

The trip duration on average lasts longer on weekends.

4.3.10 Question

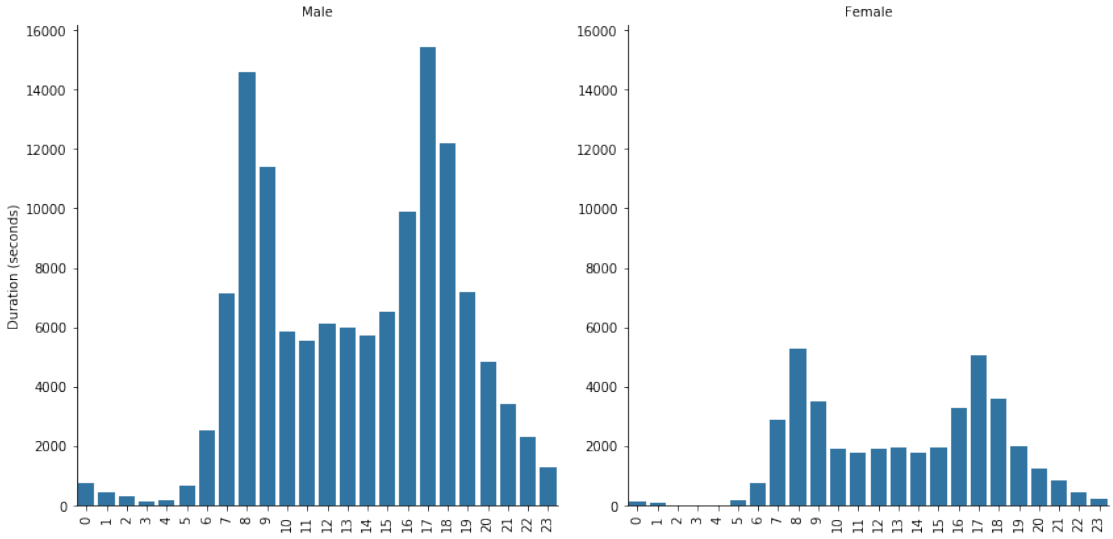
What are the peak hours when the bike service is being used?

4.3.11 Visual

```
In [51]: # Create column with hour containing the start date
         df_clean['hour'] = df_clean.start_time.dt.hour
```

```
In [52]: # Plot the Seaborn's FacetGrid
         subSet = df_clean.groupby(['member_gender','hour']).count().reset_index()
         g = sb.FacetGrid(data = subSet, size=6, col = 'member_gender', col_order=['Male','Femal
```

```
g.map(sb.barplot, 'hour', 'duration_sec');
g.set_ylabels('Duration (seconds)');
g.set_xlabels('')
g.set_xticklabels(rotation=90)
g.set_titles('{col_name}');
```



4.3.12 Answer

There is a bimodal distribution, since this is a count and previously we saw that weekdays contain the highest count of rides this charts suggest that work start and end are the peak hours. (8am and 5pm).

4.3.13 Features that strengthened each other in terms of looking at your feature(s) of interest.

The latest part suggests that this service is used mainly by young working men and for around 10 minutes.

4.3.14 Interesting or surprising interactions between features.

It surprised me that the ammount of men using this service is significantly higher that women.

4.4 Conclusions

The Ford GoBike generating sales for 0.5M usd and helping the city to lower traffic, contamination, helping people save on gas, improving their health is something that other cities should be modeling.
With 180k+ rides a month this is without a doubt a widely adopted system.
For the analysis we can conclude that the users are mainly young men using the bikes for 10min trips on weekdays.