Part_I_exploration_template

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1 Part I - (Ford GoBike System Data)

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1.2 Introduction

Ford GoBike system includes information about individual rides made in a bike-sharing system covering the San Francisco Bay area, it have multiple interesting columns as year of birth and the gender of the bike rider and the duration in seconds, the data was collected only in Feburary 2019.

1.3 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 math import sin, cos, sqrt, atan2, radians
        %matplotlib inline
```

Load in your dataset and describe its properties through the questions below. Try and motivate your exploration goals through this section.

```
In [2]: df = pd.read_csv('201902-fordgobike-tripdata.csv')
        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 [3]:
```
df.shape
```

Out[3]: (183412, 16)

In [4]:
```
df.sample(10)
```

Out[4]:

	duration_sec	start_time	end_time	start_station_id	start_station_name	start_station_latitude	start_station_longitude	end_station_id
55197	1080	2019-02-21 10:35:02.4910	2019-02-21 10:53:02.9900	52.0	McAllister St at Baker St	37.777416	-122.441838	321.0
180511	736	2019-02-01 10:46:26.8590	2019-02-01 10:58:43.5550	254.0	Vine St at Shattuck Ave	37.880222	-122.269592	263.0
153345	136	2019-02-06 13:00:23.4730	2019-02-06 13:02:40.4590	104.0	4th St at 16th St	37.767045	-122.390833	116.0
20906	700	2019-02-26 10:02:01.7800	2019-02-26 10:13:41.8470	89.0	Division St at Potrero Ave	37.769218	-122.407646	5.0
96279	440	2019-02-15 10:54:29.3630	2019-02-15 11:01:49.4880	58.0	Market St at 10th St	37.776619	-122.417385	121.0
172912	1778	2019-02-03 13:56:47.2310	2019-02-03 14:26:25.7890	284.0	Yerba Buena Center for the Arts (Howard St at ...	37.784872	-122.400876	6.0
68849	155	2019-02-19 21:02:39.0670	2019-02-19 21:05:14.6130	112.0	Harrison St at 17th St			
16209	259	2019-02-27 08:46:56.6370	2019-02-27 08:51:16.3560	43.0	San Francisco Public Library (Grove St at Hyde...			
181462	523	2019-02-01 09:09:40.9900	2019-02-01 09:18:24.9790	81.0	Berry St at 4th St			
149004	930	2019-02-06 20:04:21.3100	2019-02-06 20:19:51.9060	88.0	11th St at Bryant St			

```
68849                37.763847              -122.413004            99.0
16209                37.778768              -122.415929            62.0
181462               37.775880              -122.393170            28.0
149004               37.770030              -122.411726            44.0

                                        end_station_name  \
55197                                   5th St at Folsom
180511                     Channing Way at San Pablo Ave
153345                        Mississippi St at 17th St
20906        Powell St BART Station (Market St at 5th St)
96279                                 Mission Playground
172912                     The Embarcadero at Sansome St
68849                              Folsom St at 15th St
16209                        Victoria Manalo Draves Park
181462                      The Embarcadero at Bryant St
149004  Civic Center/UN Plaza BART Station (Market St ...

        end_station_latitude  end_station_longitude  bike_id   user_type  \
55197               37.780146            -122.403071     1600    Customer
180511              37.862827            -122.290230      959  Subscriber
153345              37.764802            -122.394771     4706  Subscriber
20906               37.783899            -122.408445     4742    Customer
96279               37.759210            -122.421339     4804  Subscriber
172912              37.804770            -122.403234     5547  Subscriber
68849               37.767037            -122.415443     6165  Subscriber
16209               37.777791            -122.406432     5469  Subscriber
181462              37.787168            -122.388098     2134  Subscriber
149004              37.781074            -122.411738     1468  Subscriber

        member_birth_year member_gender bike_share_for_all_trip
55197              1980.0          Male                      No
180511             1992.0          Male                      No
153345             1985.0          Male                      No
20906              1982.0          Male                      No
96279              1978.0          Male                      No
172912             1984.0          Male                      No
68849              1991.0        Female                      No
16209              1980.0        Female                      No
181462             1981.0          Male                      No
149004             1987.0        Female                      No
```

In [5]:
```
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
```

1.4 Before going to the Exploration, I want to make some changes to dataset

1.4.1 First I want duration colum to be in Minutes

```
In [6]: df['duration_sec'] = df['duration_sec']/60
        df.rename(columns = {'duration_sec':'duration_minute'}, inplace = True)

In [7]: df['duration_minute'] = df['duration_minute'].astype(int)

In [8]: df.head(10)
```

Out[8]:

	duration_minute	start_time	end_time
0	869	2019-02-28 17:32:10.1450	2019-03-01 08:01:55.9750
1	708	2019-02-28 18:53:21.7890	2019-03-01 06:42:03.0560
2	1030	2019-02-28 12:13:13.2180	2019-03-01 05:24:08.1460
3	608	2019-02-28 17:54:26.0100	2019-03-01 04:02:36.8420
4	26	2019-02-28 23:54:18.5490	2019-03-01 00:20:44.0740
5	29	2019-02-28 23:49:58.6320	2019-03-01 00:19:51.7600
6	19	2019-02-28 23:55:35.1040	2019-03-01 00:14:42.5880
7	26	2019-02-28 23:41:06.7660	2019-03-01 00:08:02.7560
8	26	2019-02-28 23:41:48.7900	2019-03-01 00:07:59.7150
9	17	2019-02-28 23:49:47.6990	2019-03-01 00:07:17.0250

	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
5              93.0                          4th St at Mission Bay Blvd S
6             300.0                                 Palm St at Willow St
7              10.0                            Washington St at Kearny St
8              10.0                            Washington St at Kearny St
9              19.0                                 Post St at Kearny St

   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
5               37.770407              -122.391198          323.0
6               37.317298              -121.884995          312.0
7               37.795393              -122.404770          127.0
8               37.795393              -122.404770          127.0
9               37.788975              -122.403452          121.0

                             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
5                           Broadway at Kearny             37.798014
6                     San Jose Diridon Station             37.329732
7                       Valencia St at 21st St             37.756708
8                       Valencia St at 21st St             37.756708
9                           Mission Playground             37.759210

   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
5            -122.405950     5200  Subscriber             1959.0
6            -121.901782     3803  Subscriber             1983.0
7            -122.421025     6329  Subscriber             1989.0
8            -122.421025     6548  Subscriber             1988.0
9            -122.421339     6488  Subscriber             1992.0

  member_gender bike_share_for_all_trip
```

```
0          Male                    No
1           NaN                    No
2          Male                    No
3         Other                    No
4          Male                   Yes
5          Male                    No
6        Female                    No
7          Male                    No
8         Other                    No
9          Male                    No
```

1.5 Second I want to caluclate the Distance in Kilometers

```
In [9]: def CalculateDistance(la1,lo1,la2,lo2):

            # Approximate radius of earth in km
            R = 6373.0

            lat1 = radians(la1)
            lon1 = radians(lo1)
            lat2 = radians(la2)
            lon2 = radians(lo2)

            dlon = lon2 - lon1
            dlat = lat2 - lat1

            a = sin(dlat / 2)**2 + cos(lat1) * cos(lat2) * sin(dlon / 2)**2
            c = 2 * atan2(sqrt(a), sqrt(1 - a))

            return(R * c)

            #from https://stackoverflow.com/questions/19412462/getting-distance-between-two-poin
```

```
In [10]: Distance = []
         for x in range(len(df['start_time'])):
             tempDistance = CalculateDistance(df['start_station_latitude'][x],df['start_station_
             Distance.append(tempDistance)
```

```
In [11]: df['distance_KM'] = np.array(Distance)
```

```
In [12]: df.head(5)
```

```
Out[12]:    duration_minute               start_time                 end_time  \
         0              869  2019-02-28 17:32:10.1450  2019-03-01 08:01:55.9750
         1              708  2019-02-28 18:53:21.7890  2019-03-01 06:42:03.0560
         2             1030  2019-02-28 12:13:13.2180  2019-03-01 05:24:08.1460
         3              608  2019-02-28 17:54:26.0100  2019-03-01 04:02:36.8420
         4               26  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  distance_KM
0          Male                     No     0.544879
1           NaN                     No     1.743546
2          Male                     No     2.705394
3         Other                     No     0.260820
4          Male                    Yes     2.410058
```

1.5.1 start_station_latitude , start_station_longitude , end_station_latitude , end_station_longitude is not needed

```
In [13]: df.drop(['start_station_latitude' , 'start_station_longitude' , 'end_station_latitude'
```

```
In [14]: df.head(5)
```

```
Out[14]:    duration_minute               start_time                 end_time  \
0              869  2019-02-28 17:32:10.1450  2019-03-01 08:01:55.9750
1              708  2019-02-28 18:53:21.7890  2019-03-01 06:42:03.0560
2             1030  2019-02-28 12:13:13.2180  2019-03-01 05:24:08.1460
3              608  2019-02-28 17:54:26.0100  2019-03-01 04:02:36.8420
4               26  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

   end_station_id                             end_station_name  bike_id  \
0            13.0               Commercial St at Montgomery St     4902
1            81.0                           Berry St at 4th St     2535
2             3.0  Powell St BART Station (Market St at 4th St)     5905
3            70.0                       Central Ave at Fell St     6638
4           222.0                        10th Ave at E 15th St     4898

    user_type  member_birth_year member_gender bike_share_for_all_trip  \
0    Customer             1984.0          Male                      No
1    Customer                NaN           NaN                      No
2    Customer             1972.0          Male                      No
3  Subscriber             1989.0         Other                      No
4  Subscriber             1974.0          Male                     Yes

   distance_KM
0     0.544879
1     1.743546
2     2.705394
3     0.260820
4     2.410058
```

In [15]: df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 183412 entries, 0 to 183411
Data columns (total 13 columns):
duration_minute            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
end_station_id             183215 non-null float64
end_station_name           183215 non-null object
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
distance_KM                183412 non-null float64
dtypes: float64(4), int64(2), object(7)
```

```
memory usage: 18.2+ MB
```

1.5.2 member_birth_year change data type to int

```
In [16]: df['member_birth_year'] = df['member_birth_year'].fillna(0)
         df['member_birth_year'] = df['member_birth_year'].astype(int)
```

```
In [17]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 183412 entries, 0 to 183411
Data columns (total 13 columns):
duration_minute            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
end_station_id             183215 non-null float64
end_station_name           183215 non-null object
bike_id                    183412 non-null int64
user_type                  183412 non-null object
member_birth_year          183412 non-null int64
member_gender              175147 non-null object
bike_share_for_all_trip    183412 non-null object
distance_KM                183412 non-null float64
dtypes: float64(3), int64(3), object(7)
memory usage: 18.2+ MB
```

I will make Age coulmns to be more clear the birth of year, since the dataset was recorded in 2019 i will subtract the year coulns witn 2019 to get the age

```
In [18]: df['Age'] = 2019 - df['member_birth_year']
```

1.5.3 What is the structure of your dataset?

The dataset that I choose have 13 columns with (3) float columns and (7) string and (3) integer, with 183412 rows, it have categorical nominal data like gender and user_type, there is quantitative continuous data like duration

1.5.4 What is/are the main feature(s) of interest in your dataset?

duration_sec and member_birth_year for me is the main interest here, I have a lot of interesting question about it, and i want to know is the age really matter here or no

1.5.5 What features in the dataset do you think will help support your investigation into your feature(s) of interest?

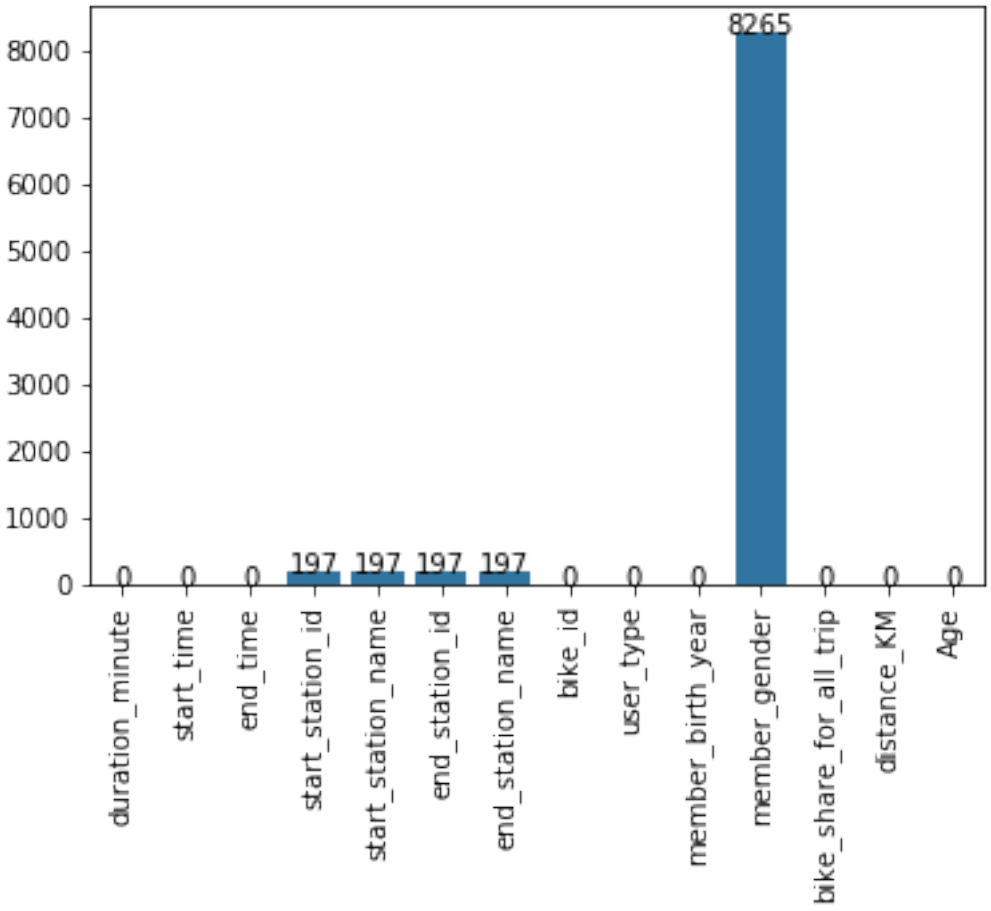
I think user_type will have strong relationship here because anyone subscribed should have more second than customer.

1.6 Univariate Exploration

1.7 Question: What is the frequency of Null values in the dataset?

1.7.1 Visualization

```
In [19]: na_counts = df.isna().sum()
         base_color = sb.color_palette()[0]
         sb.barplot(na_counts.index.values, na_counts,color = base_color)
         plt.xticks(rotation=90)
         for i in range (na_counts.shape[0]):
             count = na_counts[i]
             plt.text(i, count+300, count, ha = 'center', va='top')
```



1.7.2 Observation: We have a lot of null values in the Member_gender and the rest have low to none null values, we need to drop them

```
In [20]: df.dropna(inplace=True)
```

```
In [21]: df.isna().sum()
```

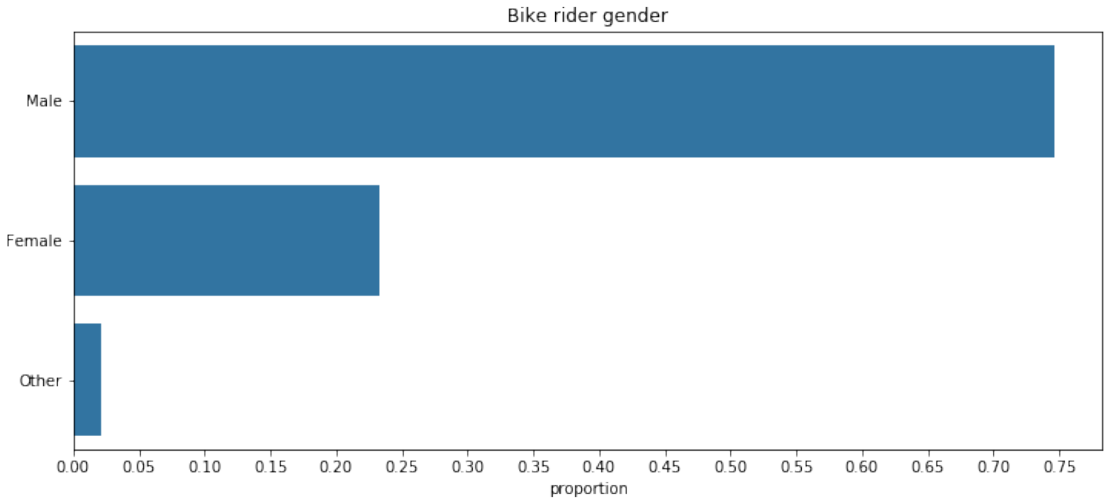
```
Out[21]: duration_minute           0
         start_time                0
         end_time                  0
         start_station_id          0
         start_station_name        0
         end_station_id            0
         end_station_name          0
         bike_id                   0
         user_type                 0
         member_birth_year         0
         member_gender             0
         bike_share_for_all_trip   0
         distance_KM               0
         Age                       0
         dtype: int64
```

1.8 Question: What the proportion of rike rider gender?

1.8.1 Visualization

```
In [22]: fig, ax = plt.subplots(figsize=(12, 5))
         type_counts = df['member_gender'].value_counts()
         type_order = type_counts.index
         All = df['member_gender'].value_counts().sum()
         max_type_count = type_counts[0]
         max_prop = max_type_count / All
         base_color = sb.color_palette()[0]
         tick_props = np.arange(0, max_prop+0.05, 0.05)
         tick_names = ['{:0.2f}'.format(v) for v in tick_props]
         sb.countplot(data = df, y = 'member_gender', color = base_color, order = type_order);
         plt.xticks(tick_props * All, tick_names)
         plt.xlabel('proportion')
         plt.ylabel('')
         plt.title('Bike rider gender')
```

```
Out[22]: Text(0.5,1,'Bike rider gender')
```



1.8.2 Observation: Male bike rider is double and half of female bike rider, Male is nearly 75% and female nearly 25%

1.9 Question: What is the perecntage of Age above 40?

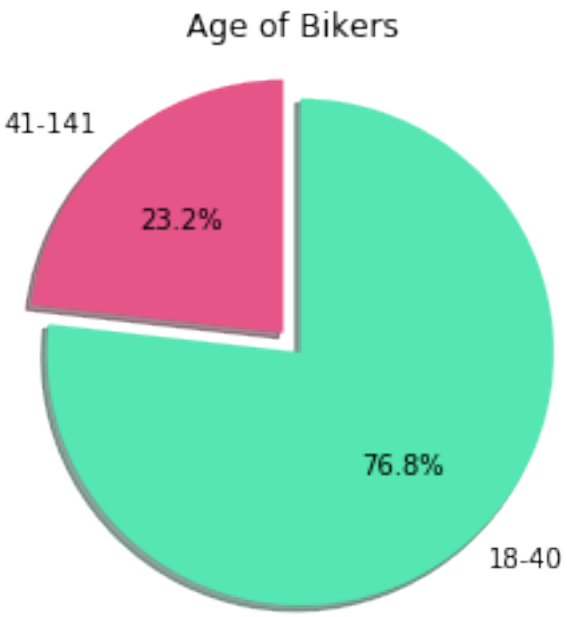
```
In [23]: df['member_birth_year'].min(),df['member_birth_year'].max()

Out[23]: (1878, 2001)

In [24]: def pie(label,size,title,color):
             labels = label
             sizes = size
             explode = (0, 0.1)
             colors = color
             fig1, ax1 = plt.subplots()
             ax1.pie(sizes, labels=labels, explode=explode,shadow=True, autopct='%1.1f%%', start
             ax1.axis('equal')
             plt.title(title)
             plt.show()
```

1.9.1 Visualization

```
In [25]: Above40 = df.query('Age >= 40')
         below40 = df.query('Age < 40')
         label = '41-141','18-40'
         size = [Above40.count()[0],below40.count()[0]]
         titlee = 'Age of Bikers'
         colors = ['#e65587','#55e6b4']
         pie(label,size,titlee,colors)
```

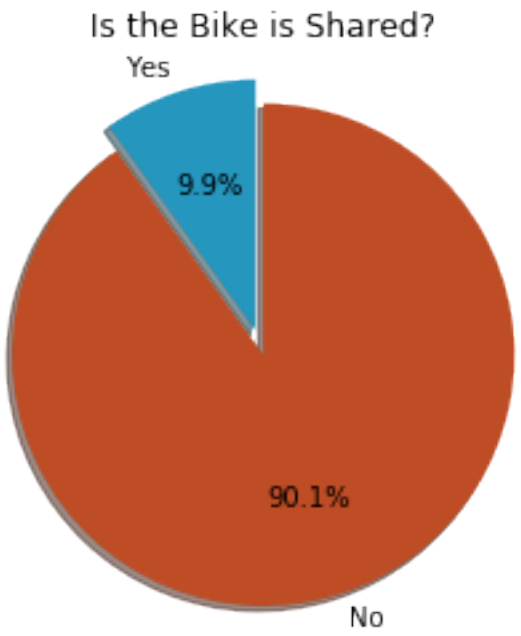


1.9.2 Observation: 76.8% is below 41 and 23.2% is above 40

1.10 Question: What is the perecntage of Bike sharing for all trip?

1.10.1 Visualization

```
In [26]: Yes = df.query('bike_share_for_all_trip == "Yes"')
         No = df.query('bike_share_for_all_trip == "No"')
         label = 'Yes','No'
         size = [Yes.count()[0],No.count()[0]]
         titlee = 'Is the Bike is Shared?'
         colors = ['#2596be','#be4d25']
         pie(label,size,titlee,colors)
```



1.10.2 Observation: 90.1% is Yes and 9.9% is No!

1.11 Question: What is the frequency of duration?

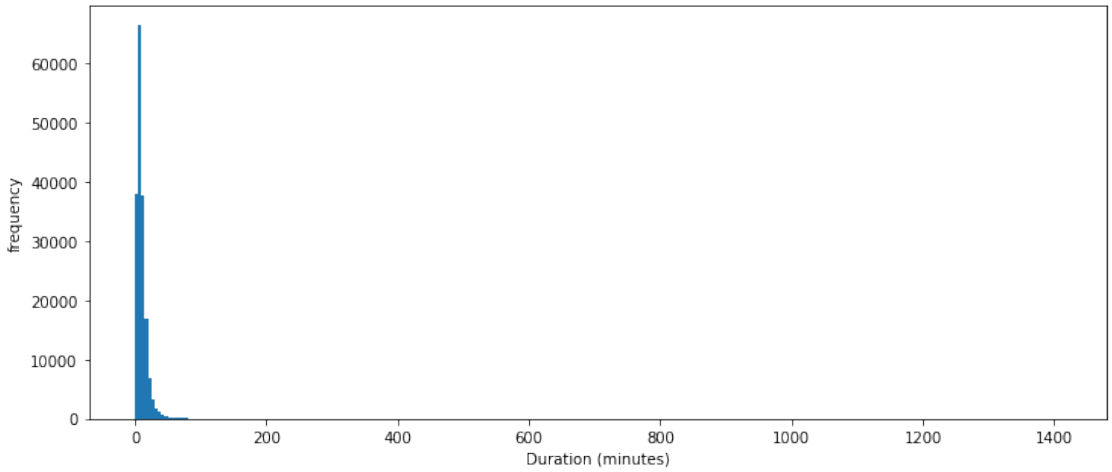
```
In [27]: df['duration_minute'].max(),df['duration_minute'].min()
```

```
Out[27]: (1409, 1)
```

1.11.1 Visuallation

```
In [28]: binsize = 5
         bins = np.arange(0, df['duration_minute'].max()+binsize,binsize)

         plt.figure(figsize=[12, 5])
         plt.hist(data = df, x = df['duration_minute'], bins = bins)
         plt.xlabel('Duration (minutes)')
         plt.ylabel('frequency')
         plt.show()
```



It seems there is problems, lets investigate

```
In [29]: df.query('distance_KM == 0')['duration_minute'].count()

Out[29]: 3458
```

Some the values have a distance equals 0, So there is a problem need to be fix, lets fix it

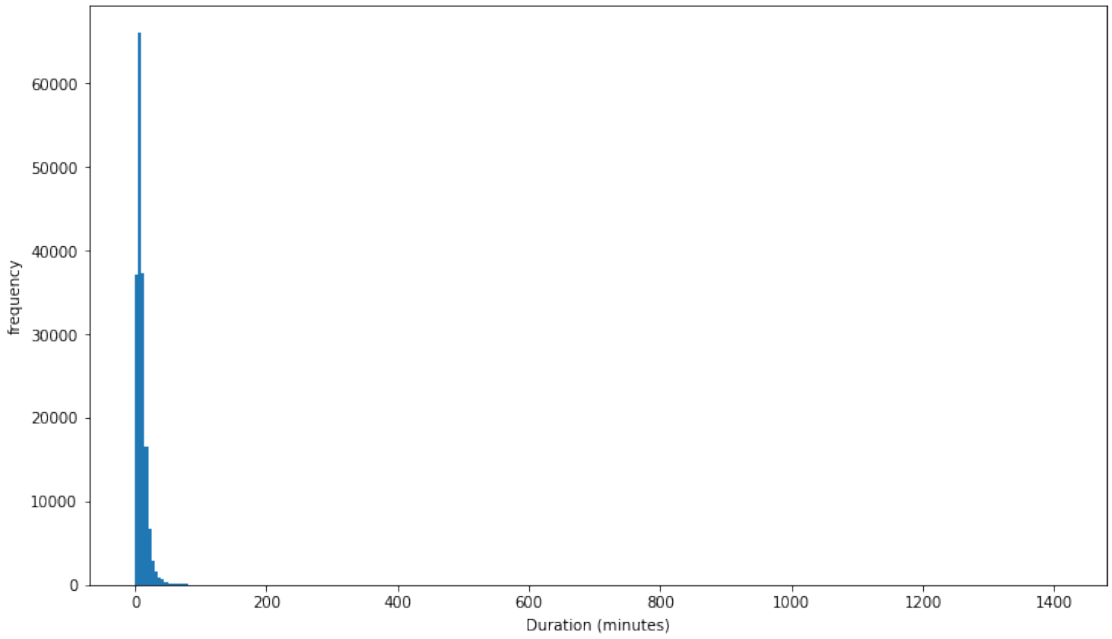
```
In [30]: df = df[df.distance_KM != 0]

In [31]: df.query("distance_KM == 0")

Out[31]: Empty DataFrame
         Columns: [duration_minute, start_time, end_time, start_station_id, start_station_name,
         Index: []

In [32]: binsize = 5
         bins = np.arange(0, df['duration_minute'].max()+binsize,binsize)

         plt.figure(figsize=[12, 7])
         plt.hist(data = df, x = df['duration_minute'], bins = bins)
         plt.xlabel('Duration (minutes)')
         plt.ylabel('frequency')
         plt.show()
```

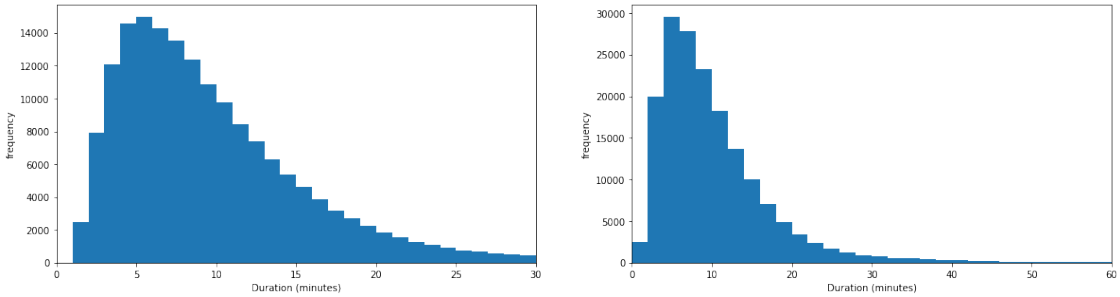


1.11.2 Still the problem occurs, in this case i'm gonna use x-axis limit (xlim) to get better look

In [33]:
```
# Define the figure size
plt.figure(figsize = [20, 5])

# histogram on left: full data
plt.subplot(1, 2, 1)
binsize = 1
bins = np.arange(0, df['duration_minute'].max()+binsize,binsize)
plt.hist(data = df, x = df['duration_minute'], bins = bins)
plt.xlabel('Duration (minutes)')
plt.ylabel('frequency')
plt.xlim(0, 30)
# histogram on right: focus in on bulk of data < 6
plt.subplot(1, 2, 2)
binsize = 2
bins = np.arange(0, df['duration_minute'].max()+binsize,binsize)
plt.hist(data = df, x = df['duration_minute'], bins = bins)
plt.xlim(0, 60) # could also be called as plt.xlim((0, 6))
plt.xlabel('Duration (minutes)')
plt.ylabel('frequency')
```

Out[33]:
```
Text(0,0.5,'frequency')
```



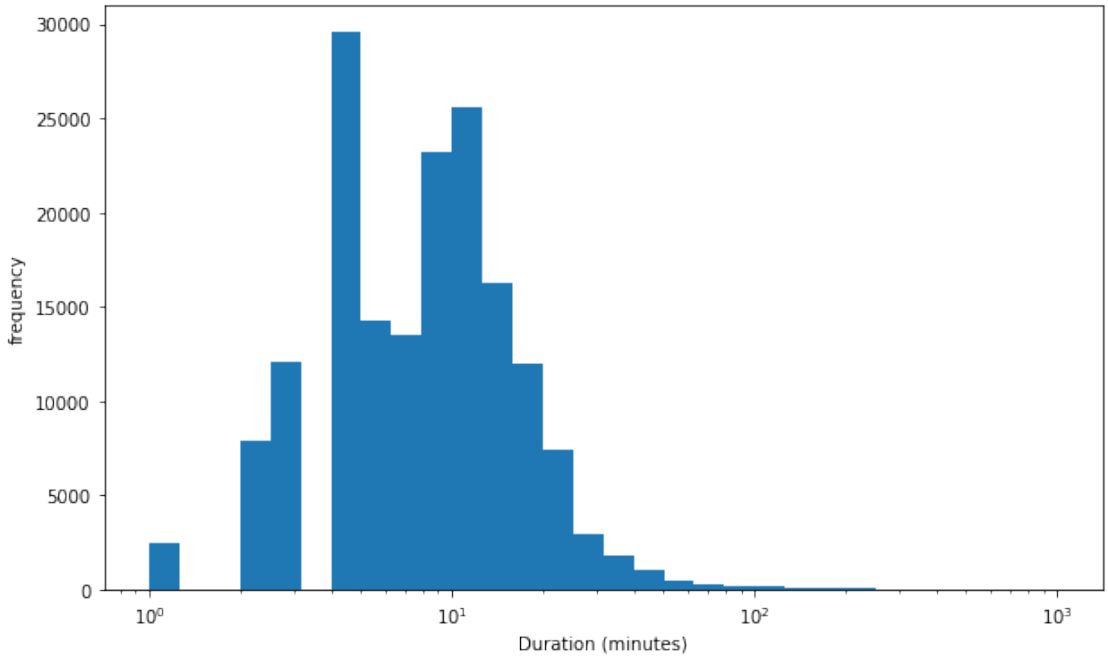
1.11.3 it's good, but I want to try the logarithmic transform to the data

```
In [34]: np.log10(df['duration_minute'].describe())
```

```
Out[34]: count    5.234249
         mean     1.036471
         std      1.407788
         min      0.000000
         25%      0.698970
         50%      0.903090
         75%      1.079181
         max      3.148911
         Name: duration_minute, dtype: float64
```

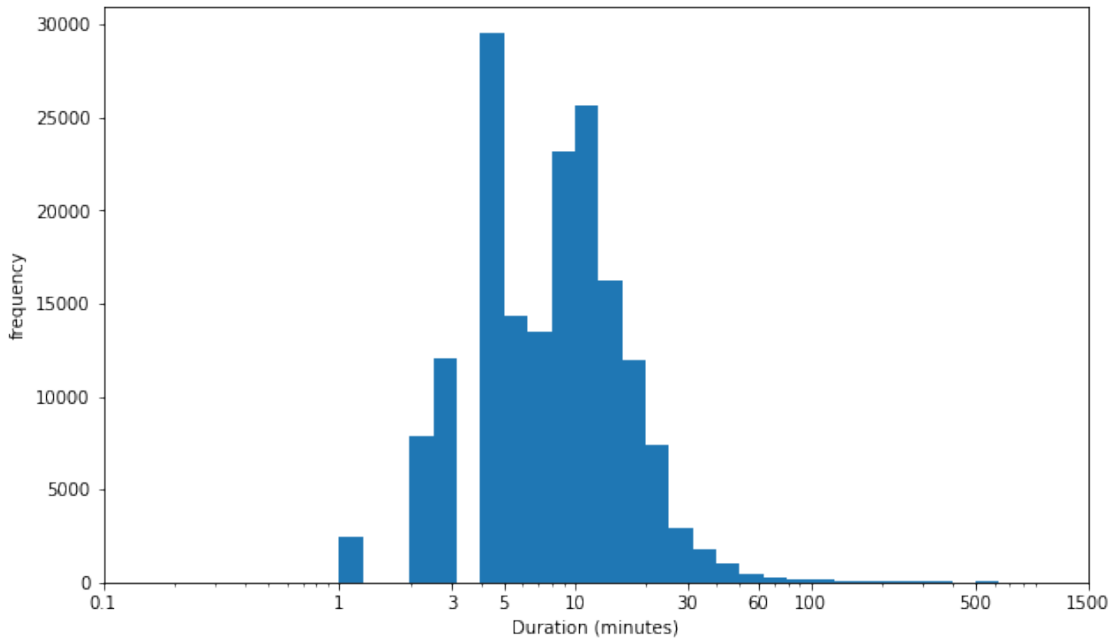
```
In [35]: binsize = 0.1
         bins = 10 ** np.arange(0, 3+binsize,binsize)

         plt.figure(figsize=[10, 6])
         plt.hist(data = df, x = df['duration_minute'], bins = bins)
         plt.xlabel('Duration (minutes)')
         plt.ylabel('frequency')
         plt.xscale('log')
         plt.show()
```



In [36]:
```
ticks = [0.1,1,3,5,10,30,60,100,500,1500]
# Convert ticks into string values, to be displaye dlong the x-axis
labels = ['{}'.format(v) for v in ticks]
binsize = 0.1
bins = 10 ** np.arange(0, 3+binsize,binsize)

plt.figure(figsize=[10, 6])
plt.hist(data = df, x = df['duration_minute'], bins = bins)
plt.xlabel('Duration (minutes)')
plt.ylabel('frequency')
plt.xscale('log')
plt.xticks(ticks, labels);
plt.show()
```



1.11.4 Thats much better

1.12 Observation:

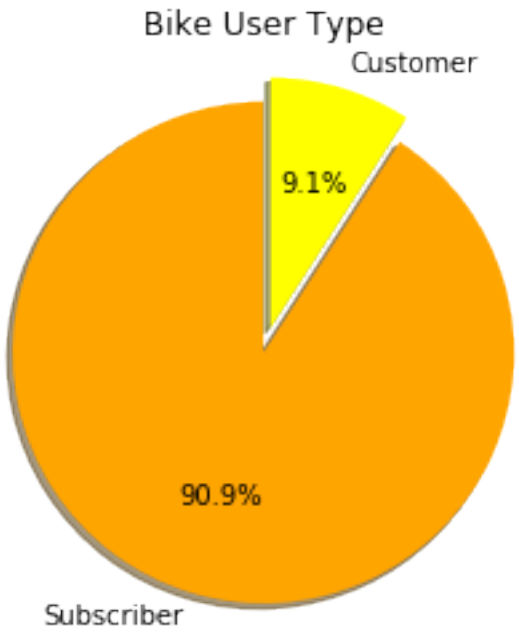
Duration Colum have a lot of outliers, so I have to try other techqniues to make the graph have meaning, the x limit to 30 is the best one it's shows that the Distance pepole take Mostly around 5 Minutes

1.13 Question: What is the perecntage of Subscribe User type?

1.13.1 Visualization

```
In [37]: #df.member_birth_year.value_counts()
         df.user_type.max(),df.user_type.min()

         #sb.barplot(df.member_birth_year.index.values, na_counts)
         label = 'Subscriber','Customer'
         size = [df.query('user_type == "Subscriber"')['user_type'].count(),df.query('user_type
         titlee = 'Bike User Type'
         colors = ['orange','yellow']
         pie(label,size,titlee,colors)
```



1.13.2 Discuss the distribution(s) of your variable(s) of interest. Were there any unusual points? Did you need to perform any transformations?

In the Duration column there was a lot of outliners, I did have to do some transformations like logarithmic transform and using x-axis limit, the rest of the columns The distrbution was normal and there was no unsuasl points, and i didn't need to do any tranforamtions.

1.13.3 Of the features you investigated, were there any unusual distributions? Did you perform any operations on the data to tidy, adjust, or change the form of the data? If so, why did you do this?

The duration column was in Seconds and I did make to minute because the minmum duration in sec and the maximum duration in sec have huge difference between them so I want to make little more narrow, and I just droped the null values so i can get accurate result, and changed some datatypes as year of birth to int.

1.14 Bivariate Exploration

```
In [38]: df.head(5)
```

```
Out[38]:    duration_minute                start_time                  end_time  \
         0              869  2019-02-28 17:32:10.1450  2019-03-01 08:01:55.9750
         2             1030  2019-02-28 12:13:13.2180  2019-03-01 05:24:08.1460
         3              608  2019-02-28 17:54:26.0100  2019-03-01 04:02:36.8420
         4               26  2019-02-28 23:54:18.5490  2019-03-01 00:20:44.0740
```

```
5               29  2019-02-28 23:49:58.6320  2019-03-01 00:19:51.7600

   start_station_id                                start_station_name  \
0              21.0  Montgomery St BART Station (Market St at 2nd St)
2              86.0                            Market St at Dolores St
3             375.0                            Grove St at Masonic Ave
4               7.0                                Frank H Ogawa Plaza
5              93.0                       4th St at Mission Bay Blvd S

   end_station_id                              end_station_name  bike_id  \
0            13.0                Commercial St at Montgomery St     4902
2             3.0  Powell St BART Station (Market St at 4th St)     5905
3            70.0                          Central Ave at Fell St     6638
4           222.0                           10th Ave at E 15th St     4898
5           323.0                              Broadway at Kearny     5200

    user_type  member_birth_year member_gender bike_share_for_all_trip  \
0    Customer               1984          Male                      No
2    Customer               1972          Male                      No
3  Subscriber               1989         Other                      No
4  Subscriber               1974          Male                     Yes
5  Subscriber               1959          Male                      No

   distance_KM  Age
0     0.544879   35
2     2.705394   47
3     0.260820   30
4     2.410058   45
5     3.333249   60
```

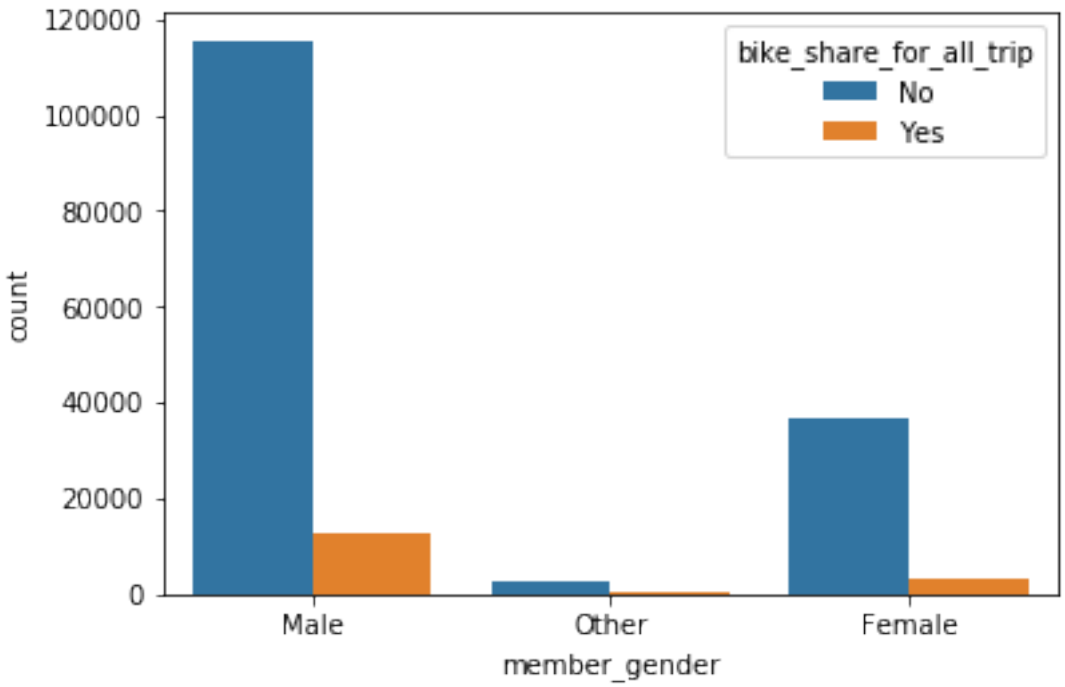
```
In [39]: df[['Age','duration_minute']].describe()
```

```
Out[39]:                 Age  duration_minute
         count  171494.000000    171494.000000
         mean       34.195278        10.876054
         std        10.084265        25.573355
         min        18.000000         1.000000
         25%        27.000000         5.000000
         50%        32.000000         8.000000
         75%        39.000000        12.000000
         max       141.000000      1409.000000
```

1.15 Question: Is there any relation between Gender and Bike Share for all trip?

1.15.1 Visualization

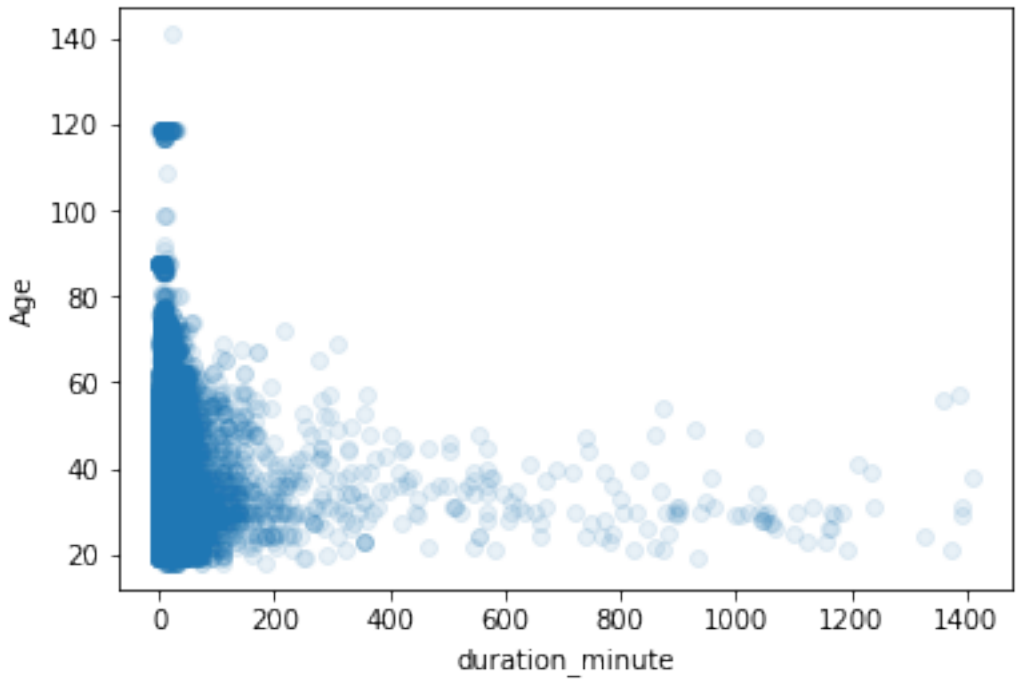
```
In [40]: sb.countplot(data = df, x = 'member_gender', hue = 'bike_share_for_all_trip');
```



1.15.2 Observation: Most of the time there is no sharing, but there is few for male and female.

1.16 Question: Is there any relation between Age and Duration?

```
In [41]: sb.regplot(data = df, y = 'Age', x = 'duration_minute', x_jitter=0.2, fit_reg = False ,
```

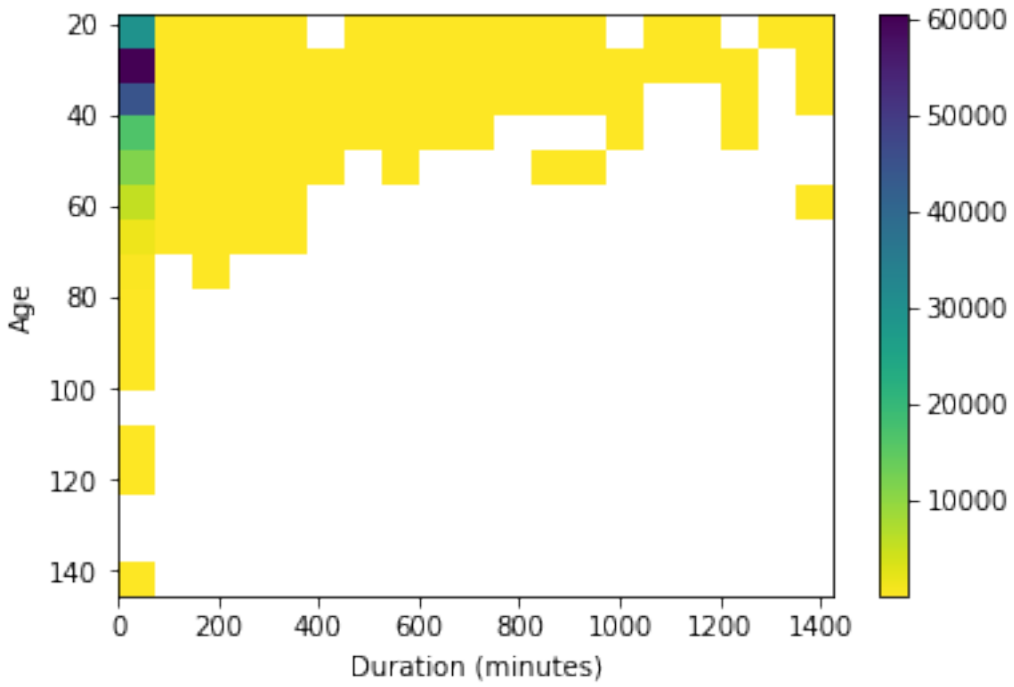


hmmm, I think heatmap will work better lets try

1.16.1 Visualization

```
In [42]: bins_y = np.arange(18,7.5+141,7.5)
         bins_x = np.arange(1,1409+75,75)
         bins = [bins_x,bins_y]
         plt.hist2d(data = df, y = 'Age', x = 'duration_minute', cmin=0.1 ,  cmap='viridis_r', b
         plt.colorbar()
         plt.gca().invert_yaxis()
         plt.xlabel('Duration (minutes)')
         plt.ylabel('Age')

Out[42]: Text(0,0.5,'Age')
```

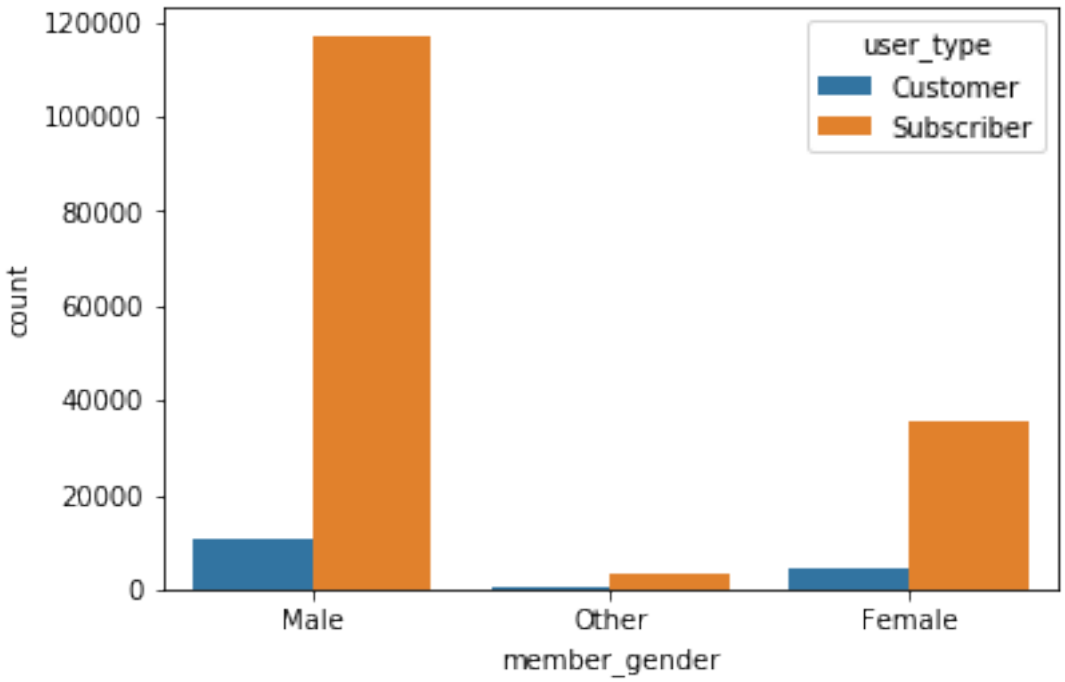


1.16.2 Observation: Younger the age the more minutes the user ride for.

1.17 Question: Is there any relation between Gender and User Type?

1.17.1 Visualization

```
In [43]: sb.countplot(data = df, x = 'member_gender', hue = 'user_type');
```



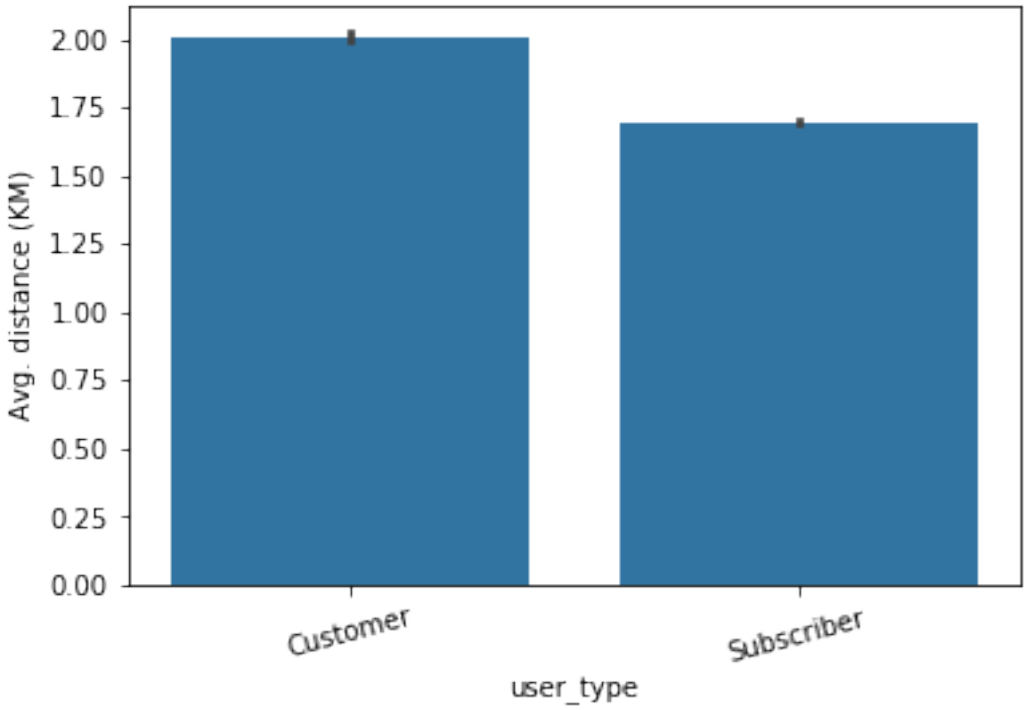
1.17.2 Observation: Male Subscirbe more than the rest, And there is huge diffrence between Subscribe male and Customer Male

1.18 Question: Is there any relation between Distance and User Type?

1.18.1 Visualization

```
In [44]: base_color = sb.color_palette()[0]
         sb.barplot(data = df, x = 'user_type', y = 'distance_KM', color=base_color)
         plt.xticks(rotation=15);
         plt.ylabel('Avg. distance (KM)')

Out[44]: Text(0,0.5,'Avg. distance (KM)')
```

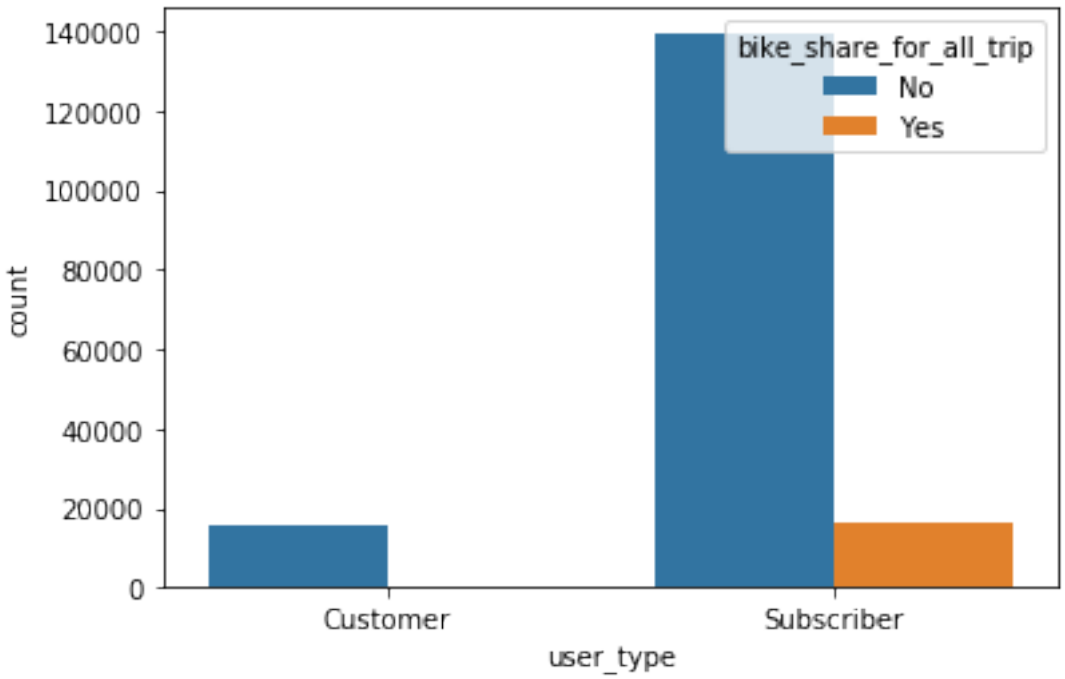


1.18.2 Observation: Customers ride for a longer distance than Subscribers

1.19 Question: Is there any relation between Bike share for all trip and User Type?

1.19.1 Visualization

```
In [45]: sb.countplot(data = df, x = 'user_type', hue = 'bike_share_for_all_trip');
```



1.19.2 Observation: There is no customer was sharing the bike, but there is few Subscriber that did

1.19.3 Talk about some of the relationships you observed in this part of the investigation. How did the feature(s) of interest vary with other features in the dataset?

I was suprised about the Male Subscribe count compare to the rest, the columns of intereset was given an interesting result when ploting them with each other

1.19.4 Did you observe any interesting relationships between the other features (not the main feature(s) of interest)?

my main foucs was on the main features of intereset, I tried some of them but they didn't show any relations.

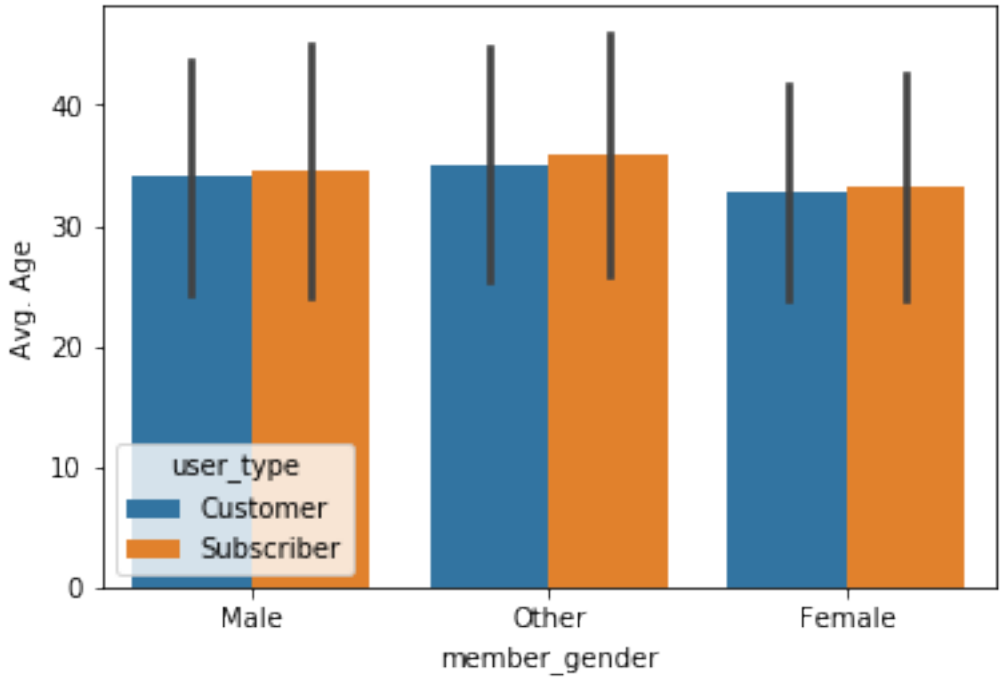
1.20 Multivariate Exploration

1.21 Question: Is there any relation between Age and User Type and Gender?

1.21.1 Visualization

```
In [46]: sb.barplot(data = df, x = 'member_gender', y= 'Age' , hue = 'user_type', ci = 'sd')
         plt.ylabel('Avg. Age')

Out[46]: Text(0,0.5,'Avg. Age')
```



1.21.2 Observation: the Avg Age in all are almost the same for Subscribers and Customer

1.21.3 Talk about some of the relationships you observed in this part of the investigation. Were there features that strengthened each other in terms of looking at your feature(s) of interest?

The relationship between Age and Distance showed that when the bike rider is younger that means it will ride for longer distance. the relationship between Customer and Subscriber, Customer surprisingly ride for longer distance than Subscribers

1.21.4 Were there any interesting or surprising interactions between features?

The relationship between Customer and Subscriber, Customer surprisingly ride for longer distance than Subscribers

1.22 Conclusions

After investgating in ford GoBike system there is interesting information i gained, Male is more likely to subscirbe to bike system, the avereage duration rider will take between 5-12 minutes, older people (below 1989) likes bikes more than younger generation (1990 and above)