Part_I_exploration_template

October 14, 2022

1 Part I - (Ford GoBike System Data)

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1.2 Introduction

This data set includes information about individual rides made in a bike-sharing system covering the greater San Francisco Bay area.

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
        %matplotlib inline
```

```
In [2]: # Load the dataset
        df = pd.read_csv('fordgobike-tripdata.csv')
```

```
In [3]: # Print the head of dataset
        df.head()
```

```
Out[3]:    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 [4]:
```
# Checking dataset info
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
```

- Need to change the datatype of some columns like ('start_time','end_time',...).
- Getting duration per minutes or hours.
- Getting the month , day , hour from 'start_time'&'end_time' columns.
- Remove unmecessary columns.

```
In [5]: # Checking number of rows and columns in the dataset
        df.shape
```

```
Out[5]: (183412, 16)
```

```
In [10]: # Checking data describe
         df.describe()
```

Out[10]:

	duration_sec	start_station_id	start_station_latitude	start_station_longitude	end_station_id	end_station_latitude	end_station_longitude	bike_id	member_birth_year
count	183412.000000	183215.000000	183412.000000	183412.000000	183215.000000	183412.000000	183412.000000	183412.000000	175147.000000
mean	726.078435	138.590427	37.771223	-122.352664	136.249123	37.771427	-122.352250	4472.906375	1984.806437
std	1794.389780	111.778864	0.099581	0.117097	111.515131	0.099490	0.116673	1664.383394	10.116689
min	61.000000	3.000000	37.317298	-122.453704	3.000000	37.317298	-122.453704	11.000000	1878.000000
25%	325.000000	47.000000	37.770083	-122.412408	44.000000	37.770407	-122.411726	3777.000000	1980.000000
50%	514.000000	104.000000	37.780760	-122.398285	100.000000	37.781010	-122.398279	4958.000000	1987.000000
75%	796.000000	239.000000	37.797280	-122.286533	235.000000	37.797320	-122.288045	5502.000000	1992.000000
max	85444.000000	398.000000	37.880222	-121.874119	398.000000	37.880222	-121.874119	6645.000000	2001.000000

- Need to check the min of member birth year.
- Getting the Age of riders from 'member_birth_year'.

```
In [11]: # Review user_type values
         df.user_type.value_counts()

Out[11]: Subscriber    163544
         Customer       19868
         Name: user_type, dtype: int64

In [12]: # Review member_gender values
         df.member_gender.value_counts()

Out[12]: Male      130651
         Female     40844
         Other       3652
         Name: member_gender, dtype: int64

In [13]: # Checking duplicates values
         df.duplicated().sum()

Out[13]: 0

In [14]: # Checking Null values
         df.isnull().sum()

Out[14]: duration_sec                  0
         start_time                    0
         end_time                      0
         start_station_id            197
         start_station_name          197
         start_station_latitude        0
         start_station_longitude       0
         end_station_id              197
         end_station_name            197
         end_station_latitude          0
         end_station_longitude         0
         bike_id                       0
         user_type                     0
         member_birth_year          8265
         member_gender              8265
         bike_share_for_all_trip       0
         dtype: int64
```

- There are null values need to drop it.

```
In [15]: # Create a copy of original dataset to cleaning it.
         gobike = df.copy()
```

```
In [16]: # Drop null values
         gobike.dropna(inplace=True)

In [17]: gobike.isnull().sum()

Out[17]: duration_sec              0
         start_time                0
         end_time                  0
         start_station_id          0
         start_station_name        0
         start_station_latitude    0
         start_station_longitude   0
         end_station_id            0
         end_station_name          0
         end_station_latitude      0
         end_station_longitude     0
         bike_id                   0
         user_type                 0
         member_birth_year         0
         member_gender             0
         bike_share_for_all_trip   0
         dtype: int64

In [18]: gobike.info()

<class 'pandas.core.frame.DataFrame'>
Int64Index: 174952 entries, 0 to 183411
Data columns (total 16 columns):
duration_sec               174952 non-null int64
start_time                 174952 non-null object
end_time                   174952 non-null object
start_station_id           174952 non-null float64
start_station_name         174952 non-null object
start_station_latitude     174952 non-null float64
start_station_longitude    174952 non-null float64
end_station_id             174952 non-null float64
end_station_name           174952 non-null object
end_station_latitude       174952 non-null float64
end_station_longitude      174952 non-null float64
bike_id                    174952 non-null int64
user_type                  174952 non-null object
member_birth_year          174952 non-null float64
member_gender              174952 non-null object
bike_share_for_all_trip    174952 non-null object
dtypes: float64(7), int64(2), object(7)
memory usage: 22.7+ MB
```

```
In [19]: # Convert the datatype of 'start_time'  & 'end_time' to datetime
         gobike.start_time = pd.to_datetime(gobike.start_time)
         gobike.end_time = pd.to_datetime(gobike.end_time)

In [20]: # Convert the datatype of 'member_birth_year' to int
         gobike.member_birth_year = gobike.member_birth_year.astype(int)

In [21]: # convert the dataype of 'start_station_id' & 'end_station_id' to int
         gobike.start_station_id = gobike.start_station_id.astype(int)
         gobike.end_station_id = gobike.end_station_id.astype(int)

In [22]: gobike.info()

<class 'pandas.core.frame.DataFrame'>
Int64Index: 174952 entries, 0 to 183411
Data columns (total 16 columns):
duration_sec               174952 non-null int64
start_time                 174952 non-null datetime64[ns]
end_time                   174952 non-null datetime64[ns]
start_station_id           174952 non-null int64
start_station_name         174952 non-null object
start_station_latitude     174952 non-null float64
start_station_longitude    174952 non-null float64
end_station_id             174952 non-null int64
end_station_name           174952 non-null object
end_station_latitude       174952 non-null float64
end_station_longitude      174952 non-null float64
bike_id                    174952 non-null int64
user_type                  174952 non-null object
member_birth_year          174952 non-null int64
member_gender              174952 non-null object
bike_share_for_all_trip    174952 non-null object
dtypes: datetime64[ns](2), float64(4), int64(5), object(5)
memory usage: 22.7+ MB


In [23]: gobike.head()

Out[23]:    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                                start_station_name  \
         0               21  Montgomery St BART Station (Market St at 2nd St)
         2               86                           Market St at Dolores St
         3              375                           Grove St at Masonic Ave
```

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

   start_station_latitude  start_station_longitude  end_station_id  \
0               37.789625              -122.400811              13
2               37.769305              -122.426826               3
3               37.774836              -122.446546              70
4               37.804562              -122.271738             222
5               37.770407              -122.391198             323

                              end_station_name  end_station_latitude  \
0                Commercial St at Montgomery St             37.794231
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

   end_station_longitude  bike_id   user_type  member_birth_year  \
0            -122.402923     4902    Customer               1984
2            -122.404904     5905    Customer               1972
3            -122.444293     6638  Subscriber               1989
4            -122.248780     4898  Subscriber               1974
5            -122.405950     5200  Subscriber               1959

  member_gender bike_share_for_all_trip
0          Male                     No
2          Male                     No
3         Other                     No
4          Male                    Yes
5          Male                     No
```

In [24]:
```
# Change 'member_brith_year' column name to 'age' and getting the age
gobike['age'] = 2022 - gobike.member_birth_year
```

In [25]:
```
gobike.head()
```

Out[25]:
```
   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                                start_station_name  \
0                21  Montgomery St BART Station (Market St at 2nd St)
2                86                          Market St at Dolores St
3               375                          Grove St at Masonic Ave
4                 7                              Frank H Ogawa Plaza
```

```
5                93                      4th St at Mission Bay Blvd S

   start_station_latitude  start_station_longitude  end_station_id  \
0               37.789625              -122.400811              13
2               37.769305              -122.426826               3
3               37.774836              -122.446546              70
4               37.804562              -122.271738             222
5               37.770407              -122.391198             323

                              end_station_name  end_station_latitude  \
0                Commercial St at Montgomery St             37.794231
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

   end_station_longitude  bike_id   user_type  member_birth_year  \
0            -122.402923     4902    Customer               1984
2            -122.404904     5905    Customer               1972
3            -122.444293     6638  Subscriber               1989
4            -122.248780     4898  Subscriber               1974
5            -122.405950     5200  Subscriber               1959

  member_gender bike_share_for_all_trip  age
0          Male                     No   38
2          Male                     No   50
3         Other                     No   33
4          Male                    Yes   48
5          Male                     No   63
```

In [26]:
```
gobike.age.describe()
```

Out[26]:
```
count    174952.000000
mean         37.196865
std          10.118731
min          21.000000
25%          30.000000
50%          35.000000
75%          42.000000
max         144.000000
Name: age, dtype: float64
```

In [27]:
```
# Checking how many riders over 70 age
max_age = gobike.query('age >= 70').count()[0]
max_age
```

Out[27]:
```
1221
```

There are riders who are older than 70, I will be contented with those under 70 age and drop the rest.

In [28]:
```
# Drop the riders who are over 70 age
gobike = gobike.query('age <= 70')
```

In [29]:
```
# Review age describe after drop over 70 age
gobike.age.describe()
```

Out[29]:
```
count    173920.000000
mean         36.947476
std           9.561944
min          21.000000
25%          30.000000
50%          35.000000
75%          42.000000
max          70.000000
Name: age, dtype: float64
```

In [30]:
```
# Convert 'duration_sec' to be per mins and hours
gobike['duration_min'] = gobike.duration_sec/60
gobike.duration_min = gobike.duration_min.astype(int)
```

In [31]:
```
gobike.head()
```

Out[31]:

	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
0	52185	2019-02-28 17:32:10.145	2019-03-01 08:01:55.975	21	Montgomery St BART Station (Market St at 2nd St)	37.789625	-122.400811	13	Commercial St at Montgomery St	37.794231
2	61854	2019-02-28 12:13:13.218	2019-03-01 05:24:08.146	86	Market St at Dolores St	37.769305	-122.426826	3	Powell St BART Station (Market St at 4th St)	37.786375
3	36490	2019-02-28 17:54:26.010	2019-03-01 04:02:36.842	375	Grove St at Masonic Ave	37.774836	-122.446546	70	Central Ave at Fell St	37.773311
4	1585	2019-02-28 23:54:18.549	2019-03-01 00:20:44.074	7	Frank H Ogawa Plaza	37.804562	-122.271738	222	10th Ave at E 15th St	37.792714
5	1793	2019-02-28 23:49:58.632	2019-03-01 00:19:51.760	93	4th St at Mission Bay Blvd S	37.770407	-122.391198	323	Broadway at Kearny	37.798014

```
   end_station_longitude  bike_id   user_type  member_birth_year  \
0            -122.402923     4902    Customer               1984
2            -122.404904     5905    Customer               1972
3            -122.444293     6638  Subscriber               1989
4            -122.248780     4898  Subscriber               1974
5            -122.405950     5200  Subscriber               1959

  member_gender bike_share_for_all_trip  age  duration_min
0          Male                     No   38           869
2          Male                     No   50          1030
3         Other                     No   33           608
4          Male                    Yes   48            26
5          Male                     No   63            29
```

In [32]:
```
# Create new coulumns containts that 'month, day, hour' for the trip
gobike['trip_date'] = gobike.start_time.dt.strftime('%Y-%m-%d')
gobike['trip_month'] = gobike.start_time.dt.strftime('%B')
gobike['trip_day'] = gobike.start_time.dt.strftime('%A')
gobike['trip_hour'] = gobike.start_time.dt.strftime('%H')
```

In [33]:
```
gobike.head()
```

Out[33]:
```
   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                                start_station_name  \
0                21  Montgomery St BART Station (Market St at 2nd St)
2                86                            Market St at Dolores St
3               375                            Grove St at Masonic Ave
4                 7                                Frank H Ogawa Plaza
5                93                         4th St at Mission Bay Blvd S

   start_station_latitude  start_station_longitude  end_station_id  \
0               37.789625              -122.400811              13
2               37.769305              -122.426826               3
3               37.774836              -122.446546              70
4               37.804562              -122.271738             222
5               37.770407              -122.391198             323

                              end_station_name  end_station_latitude  \
0                Commercial St at Montgomery St             37.794231
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

     ...      user_type  member_birth_year member_gender  \
0    ...       Customer               1984          Male
2    ...       Customer               1972          Male
3    ...     Subscriber               1989         Other
4    ...     Subscriber               1974          Male
5    ...     Subscriber               1959          Male

   bike_share_for_all_trip age duration_min   trip_date  trip_month  trip_day  \
0                       No  38          869  2019-02-28    February  Thursday
2                       No  50         1030  2019-02-28    February  Thursday
3                       No  33          608  2019-02-28    February  Thursday
4                      Yes  48           26  2019-02-28    February  Thursday
5                       No  63           29  2019-02-28    February  Thursday

  trip_hour
0        17
2        12
3        17
4        23
5        23

[5 rows x 22 columns]
```

In [34]:
```
# Review trip_day values
gobike.trip_day.value_counts()
```

Out[34]:
```
Thursday     33525
Tuesday      30427
Wednesday    28294
Friday       27493
Monday       25474
Sunday       14378
Saturday     14329
Name: trip_day, dtype: int64
```

In [35]:
```
# review trip_month values
gobike.trip_month.value_counts()
```

Out[35]:
```
February    173920
Name: trip_month, dtype: int64
```

In [36]:
```
gobike.trip_date.describe()
```

Out[36]:
```
count         173920
unique            28
top       2019-02-28
```

```
freq            9401
Name: trip_date, dtype: object
```

- The dataset for one month only (Feb) in 2019 year.

```
In [37]: # Drop unnecessary coulmns
         gobike.drop(['start_station_latitude','start_station_longitude',
                      'end_station_latitude','end_station_longitude',
                      'bike_share_for_all_trip'],axis=1, inplace=True)

In [38]: gobike.head(10)
```

Out[38]:

	duration_sec	start_time	end_time	start_station_id	start_station_name	end_station_id	end_station_name	bike_id	user_type	member_birth_year	member_gender	age	duration_min
0	52185	2019-02-28 17:32:10.145	2019-03-01 08:01:55.975	21	Montgomery St BART Station (Market St at 2nd St)	13	Commercial St at Montgomery St	4902	Customer	1984	Male	35	869.75
2	61854	2019-02-28 12:13:13.218	2019-03-01 05:24:08.146	86	Market St at Dolores St	3	Powell St BART Station (Market St at 4th St)	5905	Customer	1972	Male	47	1030.90
3	36490	2019-02-28 17:54:26.010	2019-03-01 04:02:36.842	375	Grove St at Masonic Ave	70	Central Ave at Fell St	6638	Subscriber	1989	Other	30	608.17
4	1585	2019-02-28 23:54:18.549	2019-03-01 00:20:44.074	7	Frank H Ogawa Plaza	222	10th Ave at E 15th St	4898	Subscriber	1974	Male	45	26.42
5	1793	2019-02-28 23:49:58.632	2019-03-01 00:19:51.760	93	4th St at Mission Bay Blvd S	323	Broadway at Kearny	5200	Subscriber	1959	Male	60	29.88
6	1147	2019-02-28 23:55:35.104	2019-03-01 00:14:42.588	300	Palm St at Willow St	312	San Jose Diridon Station	5592	Subscriber	1983	Male	36	19.12
7	1615	2019-02-28 23:41:06.766	2019-03-01 00:08:02.756	10	Washington St at Kearny St	127	Valencia St at 21st St	5506	Subscriber	1989	Male	30	26.92
8	1570	2019-02-28 23:41:48.790	2019-03-01 00:07:59.715	10	Washington St at Kearny St	127	Valencia St at 21st St	2239	Subscriber	1962	Male	57	26.17
9	1049	2019-02-28 23:49:47.699	2019-03-01 00:07:17.025	19	Post St at Kearny St	121	Mission Playground	3824	Subscriber	1990	Male	29	17.48
10	458	2019-02-28 23:57:57.211	2019-03-01 00:05:35.435	370	Jones St at Post St	43	San Francisco Public Library (Grove St at Hyde...	1094	Subscriber	1988	Male	31	7.63

0	4902	Customer	1984	Male	38	869
2	5905	Customer	1972	Male	50	1030
3	6638	Subscriber	1989	Other	33	608
4	4898	Subscriber	1974	Male	48	26
5	5200	Subscriber	1959	Male	63	29
6	3803	Subscriber	1983	Female	39	19
7	6329	Subscriber	1989	Male	33	26
8	6548	Subscriber	1988	Other	34	26
9	6488	Subscriber	1992	Male	30	17
10	5318	Subscriber	1996	Female	26	7

	trip_date	trip_month	trip_day	trip_hour
0	2019-02-28	February	Thursday	17
2	2019-02-28	February	Thursday	12
3	2019-02-28	February	Thursday	17
4	2019-02-28	February	Thursday	23
5	2019-02-28	February	Thursday	23
6	2019-02-28	February	Thursday	23
7	2019-02-28	February	Thursday	23
8	2019-02-28	February	Thursday	23
9	2019-02-28	February	Thursday	23
10	2019-02-28	February	Thursday	23

In [39]: gobike.info()

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 173920 entries, 0 to 183411
Data columns (total 17 columns):
duration_sec          173920 non-null int64
start_time            173920 non-null datetime64[ns]
end_time              173920 non-null datetime64[ns]
start_station_id      173920 non-null int64
start_station_name    173920 non-null object
end_station_id        173920 non-null int64
end_station_name      173920 non-null object
bike_id               173920 non-null int64
user_type             173920 non-null object
member_birth_year     173920 non-null int64
member_gender         173920 non-null object
age                   173920 non-null int64
duration_min          173920 non-null int64
trip_date             173920 non-null object
trip_month            173920 non-null object
trip_day              173920 non-null object
trip_hour             173920 non-null object
dtypes: datetime64[ns](2), int64(7), object(8)
memory usage: 23.9+ MB
```

```
In [40]: gobike.shape

Out[40]: (173920, 17)
```

1.3.1 What is the structure of your dataset?

The dataset contains 17,3920 rows and 17 columns that repersent the bike riders in San Francisco Bay area with the following importaent vaariables:

- Trip Duration (minutes).
- Start Station (Time,Name) and End Stations (Time,Name).
- User Type ('Subscriber' = Member , 'Customer' = Unmember).
- Member Birth Year and Age.
- Member Gender.

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

I'm interested in feature out the factors of trip duration in comparing with different genders and the differences between the user type (Subscribed and Customer).

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

Trip Duration, the date of Start Time (year,month,day,hours), User Type, The Age of Riders and Gender.

1.4 Univariate Exploration

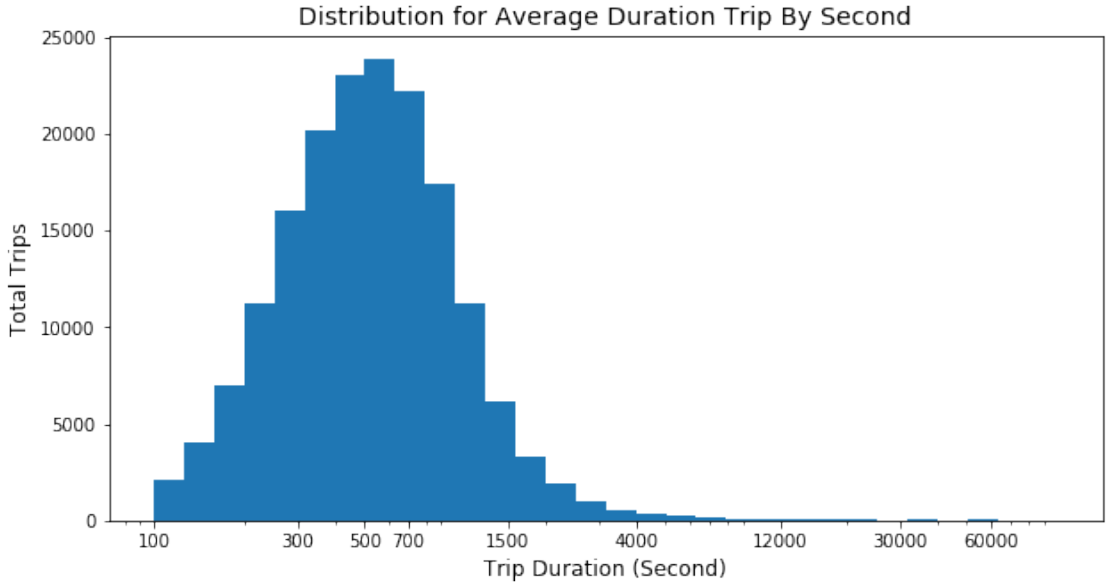
In this section, investigate distributions of individual variables. If you see unusual points or outliers, take a deeper look to clean things up and prepare yourself to look at relationships between variables.

1.4.1 What is the average of duration per Second?

```
In [41]: # Checking duration_sec describe
         gobike.duration_sec.describe()

Out[41]: count    173920.000000
         mean        704.223149
         std        1645.440119
         min          61.000000
         25%         323.000000
         50%         511.000000
         75%         789.000000
         max       84548.000000
         Name: duration_sec, dtype: float64
```

```
In [42]: # plot the durations for trip by second
         plt.figure(figsize=[10,5])
         bins = 10**np.arange(2, 5.0 + 0.1, 0.1)
         plt.hist(data=gobike,x= 'duration_sec', bins=bins)
         ticks = [100, 300, 500 ,700, 1500, 4000, 12000, 30000, 60000]
         labels = ['{}'.format(val) for val in ticks]
         plt.xscale('log')
         plt.xticks(ticks, labels)
         plt.title('Distribution for Average Duration Trip By Second', size=14)
         plt.xlabel('Trip Duration (Second)', size=12)
         plt.ylabel('Total Trips', size=12);
```



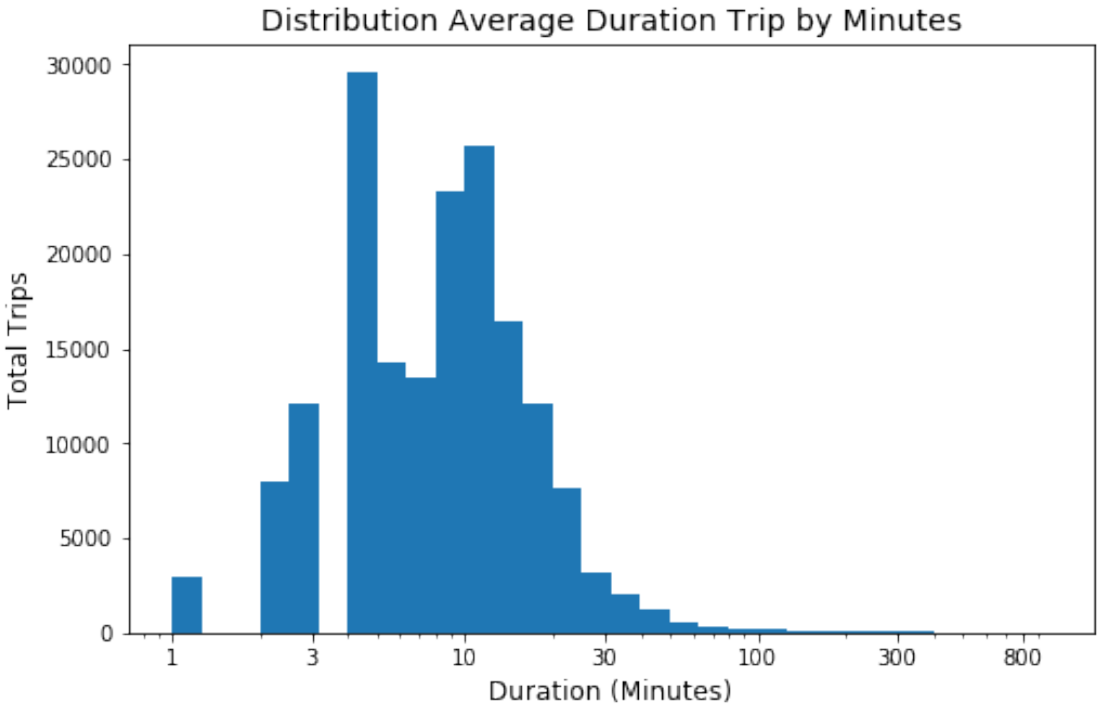
The average duration of bike trip per second is around 700(Sec)

1.4.2 What is the average of duration per Minutes?

```
In [43]: # Cheching durstion_min describe
         gobike.duration_min.describe()
```

```
Out[43]: count    173920.000000
         mean         11.245090
         std          27.425233
         min           1.000000
         25%           5.000000
         50%           8.000000
         75%          13.000000
         max        1409.000000
         Name: duration_min, dtype: float64
```

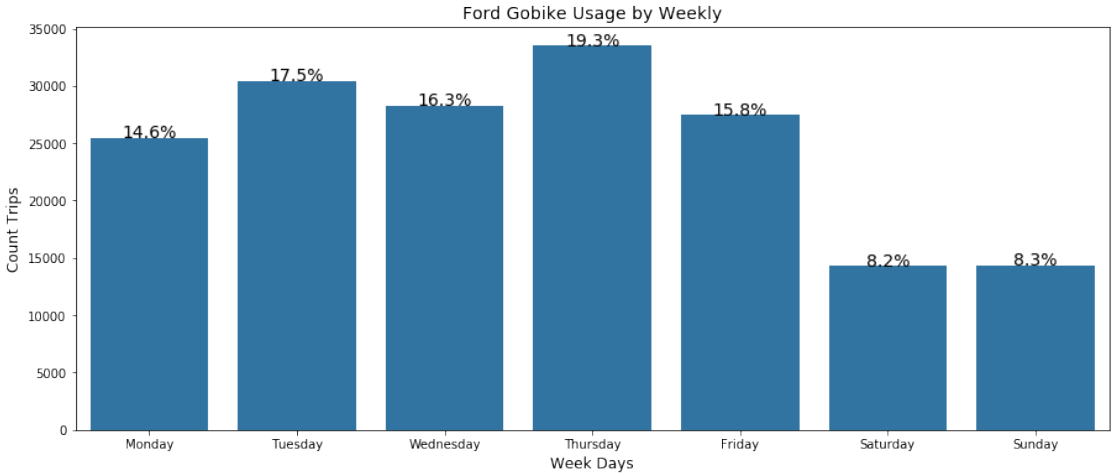
In [44]:
```
# plot the durations for trip by minutes
plt.figure(figsize=[8,5])
bins = 10**np.arange(0 , 3 + 0.1 , 0.1)
ticks = [1, 3, 10, 30, 100, 300, 800]
labels = ['{}'.format(i) for i in ticks]
plt.hist(data = gobike, x='duration_min', bins=bins)
plt.xscale('log')
plt.xticks(ticks,labels)
plt.xlabel('Duration (Minutes)', size=12)
plt.title('Distribution Average Duration Trip by Minutes', size = 14)
plt.ylabel('Total Trips', size=12);
```



The average duration of bike trip by minutes is around 11.24 (Min).

In [45]:
```
# Review total trips by weekly
plt.figure(figsize=[15,6])
sort_days = ['Monday', 'Tuesday', 'Wednesday','Thursday', 'Friday', 'Saturday', 'Sunday
color = sb.color_palette()[0]
sb.countplot(data=gobike, x='trip_day', color=color,order=sort_days)
plt.xlabel('Week Days', size=12)
plt.title('Ford Gobike Usage by Weekly', size=14)
plt.ylabel('Count Trips', size=12)
day_count = gobike.trip_day.value_counts()
total_trips = day_count.sum()
```

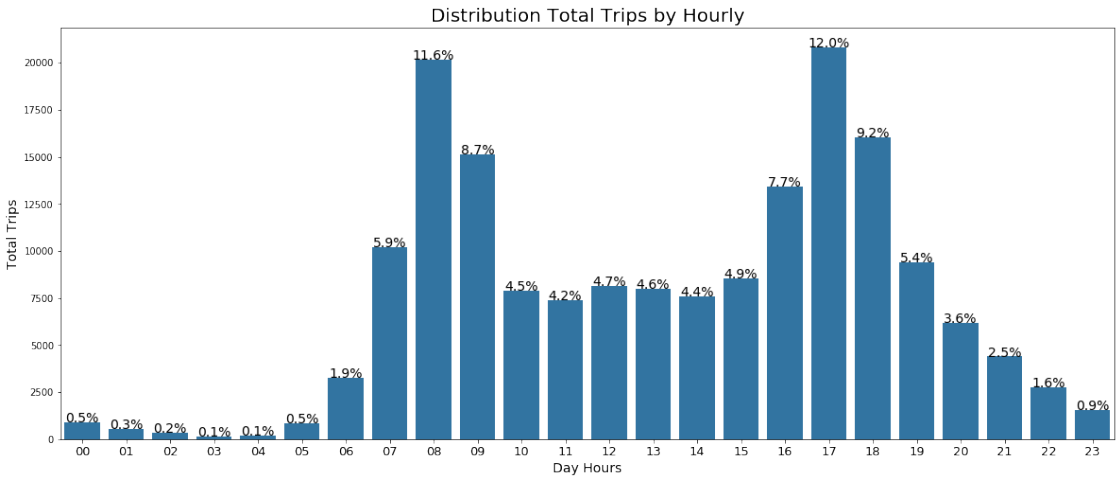
```
    locs, labels = plt.xticks(size=10)
    for loc, label in zip(locs, labels):
        count = day_count[label.get_text()]
        pct_string = '{:0.1f}%'.format(100*count/total_trips)
        plt.text(loc, count+10, pct_string, ha='center', color = 'black', fontsize=14);
```



As we see clearly the usage bikes is down in the weekend days (Sat & Sun), and coming rise up in weekdays (working days).

1.4.3 What is the peak time of trips?

```
In [46]: # Review the count of trips by hourly
         plt.figure(figsize=[20,8])
         sb.countplot(data=gobike, x='trip_hour', color=color)
         plt.xlabel('Day Hours', size=14)
         plt.ylabel('Total Trips', size=14)
         plt.title('Distribution Total Trips by Hourly', size=20)
         hour_count = gobike.trip_hour.value_counts()
         total_trips = hour_count.sum()
         locs, labels = plt.xticks(size=13)
         for loc, label in zip(locs, labels):
             count = hour_count[label.get_text()]
             pct_string = '{:0.1f}%'.format(100*count/total_trips)
             plt.text(loc, count+10, pct_string, ha= 'center', color = 'black', fontsize=14);
```



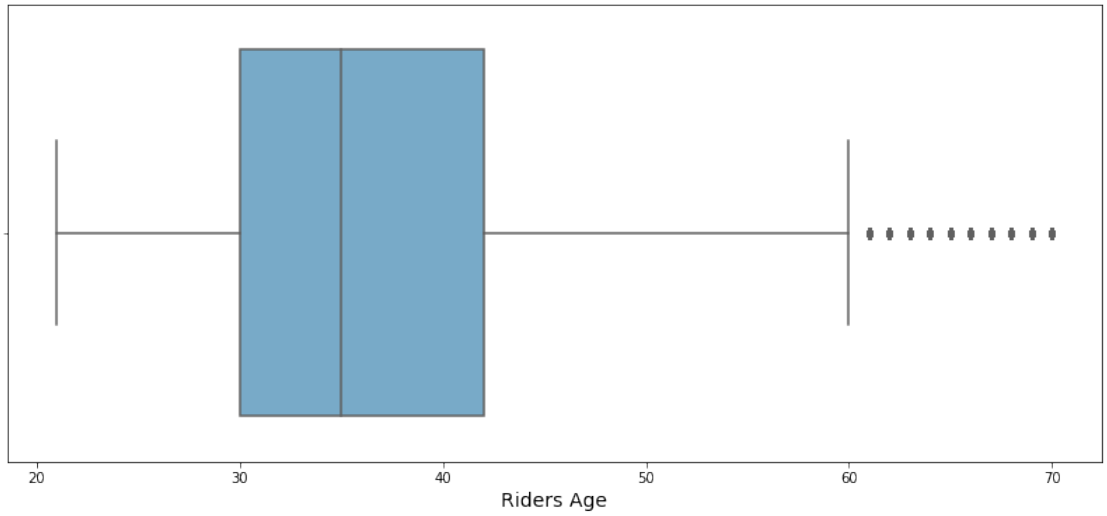
As we see, the peak time start around 08:00 AM and 05:00 PM, it's make sense because most of the jobs start and end in the same time.

1.4.4 What are the range and average of riders ages?

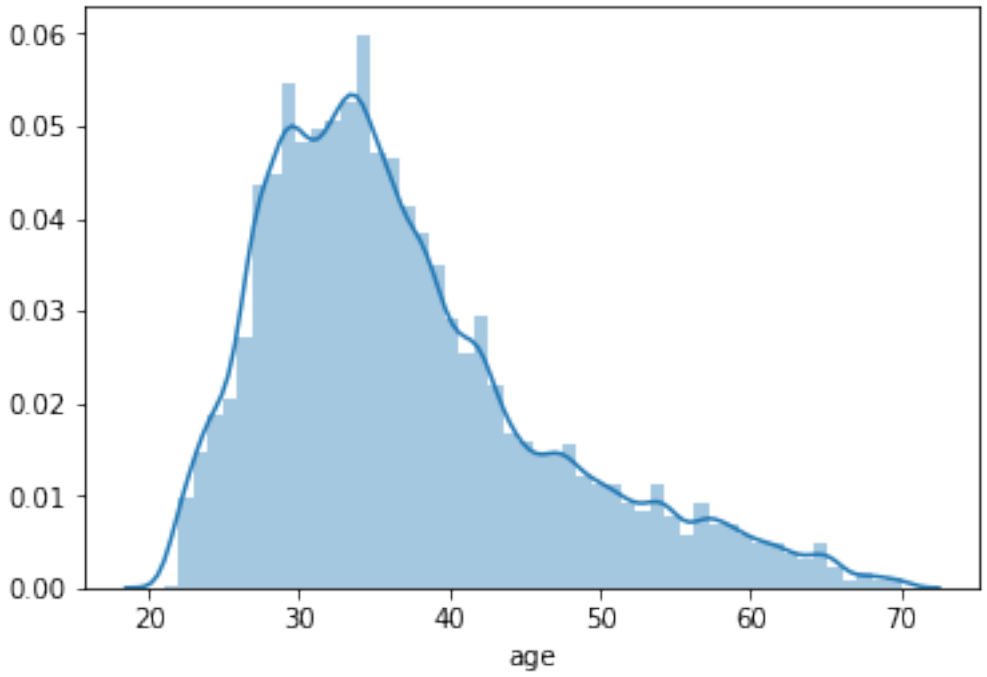
```
In [47]: # Age describe
         gobike.age.describe()
```

```
Out[47]: count    173920.000000
         mean         36.947476
         std           9.561944
         min          21.000000
         25%          30.000000
         50%          35.000000
         75%          42.000000
         max          70.000000
         Name: age, dtype: float64
```

```
In [48]: # Review Rider Age
         plt.figure(figsize=[14,6])
         sb.boxplot(data=gobike,x='age', palette='Blues')
         plt.xlabel('Riders Age', size=14);
```



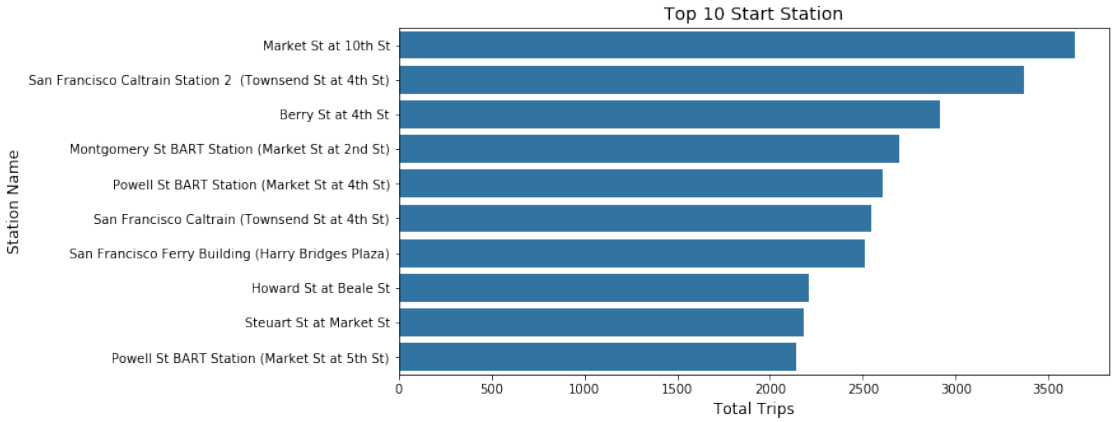
In [49]: sb.distplot(gobike.age);



As we see here the range of age is between 21 to 60 age, with outliers between 60 to 70 age, and that makes sense, the most common age is between the bike riders 30 to 42 age.

1.4.5 What is the most common start station name among riders?

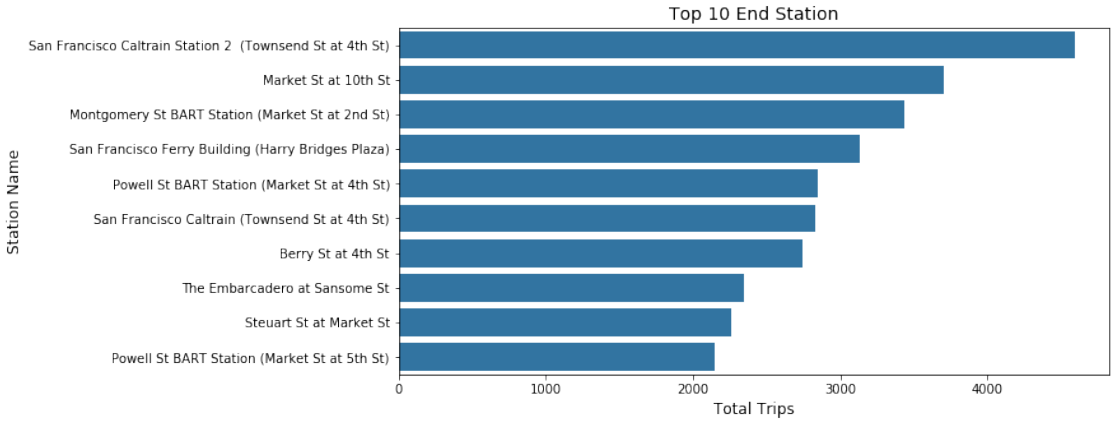
```
In [50]: # Review most start station name for riders
         plt.figure(figsize=[10,5])
         top_st_station = gobike.start_station_name.value_counts()[:10]
         top_st = top_st_station.index
         sb.countplot(data=gobike, y='start_station_name', color=color, order=top_st)
         plt.xlabel('Total Trips', size=12)
         plt.ylabel('Station Name', size=12)
         plt.title('Top 10 Start Station', size=14);
```



The most start station name at (Market St at 10th St) with more than 3,500 trips.

1.4.6 What is the most common end station name among riders?

```
In [51]: # Review most end stations name for riders
         plt.figure(figsize=[10,5])
         top_en_station = gobike.end_station_name.value_counts()[:10]
         top_en = top_en_station.index
         sb.countplot(data=gobike, y='end_station_name',color=color, order=top_en)
         plt.xlabel('Total Trips', size=12)
         plt.ylabel('Station Name', size=12)
         plt.title('Top 10 End Station', size=14);
```



The most end station name at (San Francisco Station) with more than 4,000 trips.

Rubric Tip: Visualizations should depict the data appropriately so that the plots are easily interpretable. You should choose an appropriate plot type, data encodings, and formatting as needed. The formatting may include setting/adding the title, labels, legend, and comments. Also, do not overplot or incorrectly plot ordinal data.

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

I transformed the duration second to by minutes to be readable easy and created a new column containing the rider age as per the birth year column, and created also a new columns that containing trip weekdays and day hour.

1.4.8 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?

I sorted the days of the week so that they start on Monday, the first working day of the week in San Francisco Bat area.

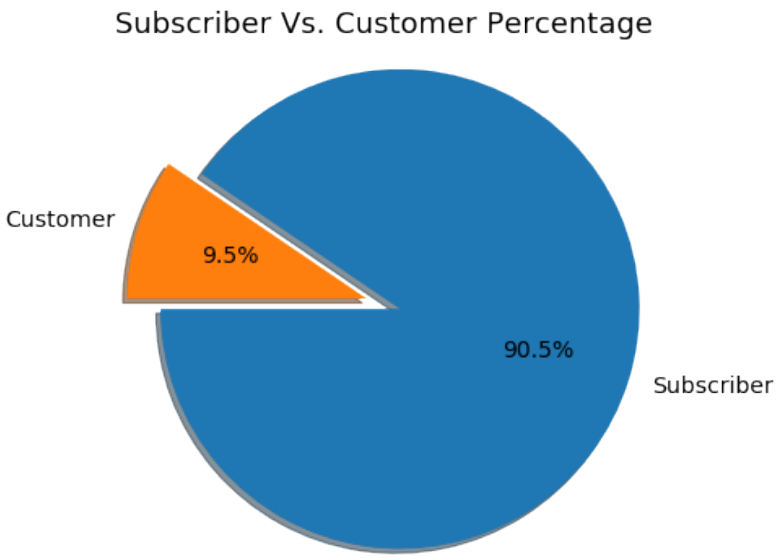
1.5 Bivariate Exploration

In this section, investigate relationships between pairs of variables in your data. Make sure the variables that you cover here have been introduced in some fashion in the previous section (univariate exploration).

1.5.1 What is the percentage for each user type?

```
In [52]: # Check the Percentage of bike riders type betweet (Subscriber & Customer)
         plt.figure(figsize=[12,6])
         bike_user = gobike.user_type.value_counts()
         labels = ['Subscriber', 'Customer']
```

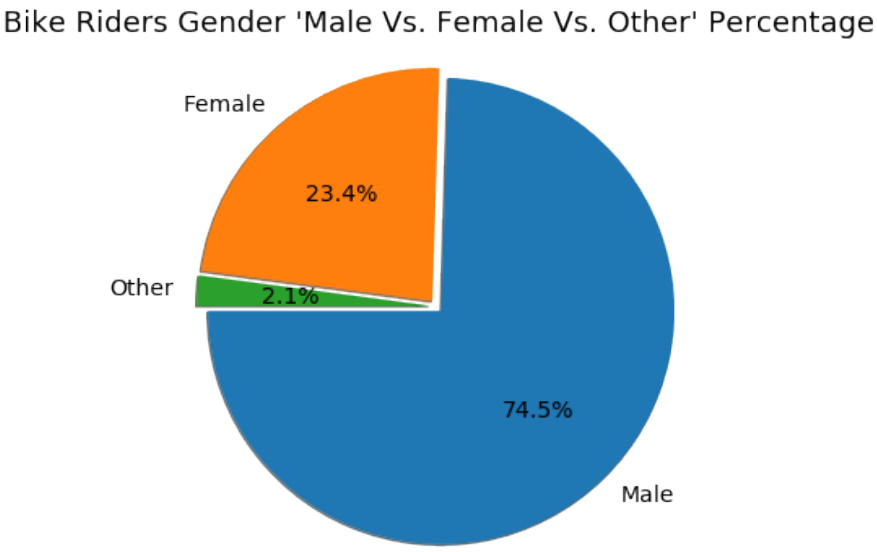
```
explode = (0, 0.16)
plt.pie(bike_user, radius=1.1, labels=labels,explode=explode, startangle=180, autopct='
plt.title('Subscriber Vs. Customer Percentage', size=18)
plt.axis('equal');
```



As we see, most of bike riders are Subscriber 'Member' with (90.5%) and the rest of bike riders are Customer with (9.5%).

1.5.2 What is the percentage for each member gender?

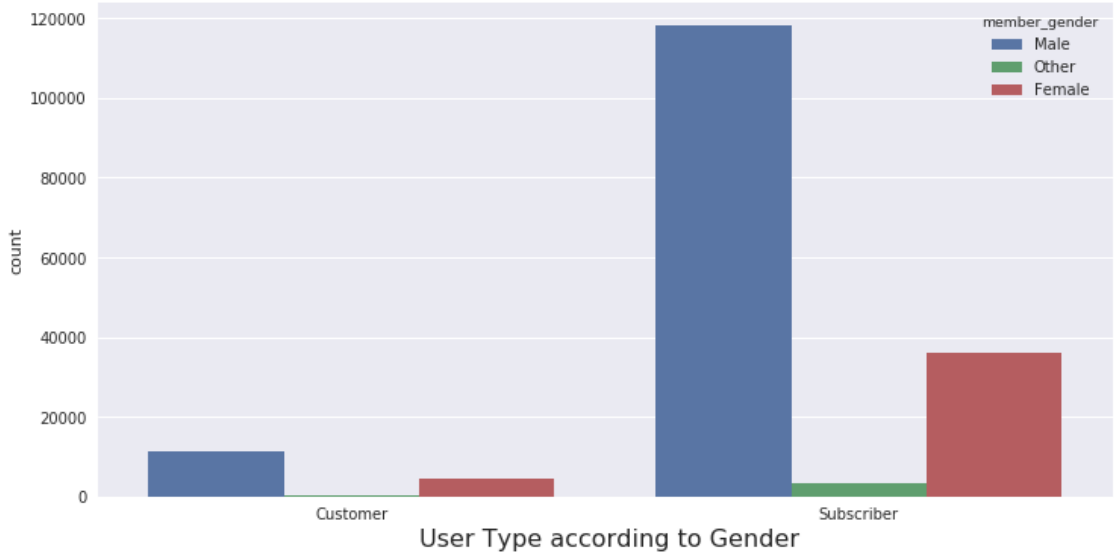
In [53]:
```
# Check the percentage of bike riders gender between (Male & Female & Other)
plt.figure(figsize=[12,6])
gender = gobike.member_gender.value_counts()
labels = ['Male', 'Female', 'Other']
explode = (0.10,0.10, 0.10)
plt.pie(gender, radius=3.5, labels=labels, explode=explode, startangle=180, autopct='%0
plt.title("Bike Riders Gender 'Male Vs. Female Vs. Other' Percentage", size=18)
plt.axis('equal');
```



As we see, it's clear the Male gender is the most bike riders by (74.5%) and Female riders the second by (23.4%).

1.5.3 What is the most common user type?, what his gender ?

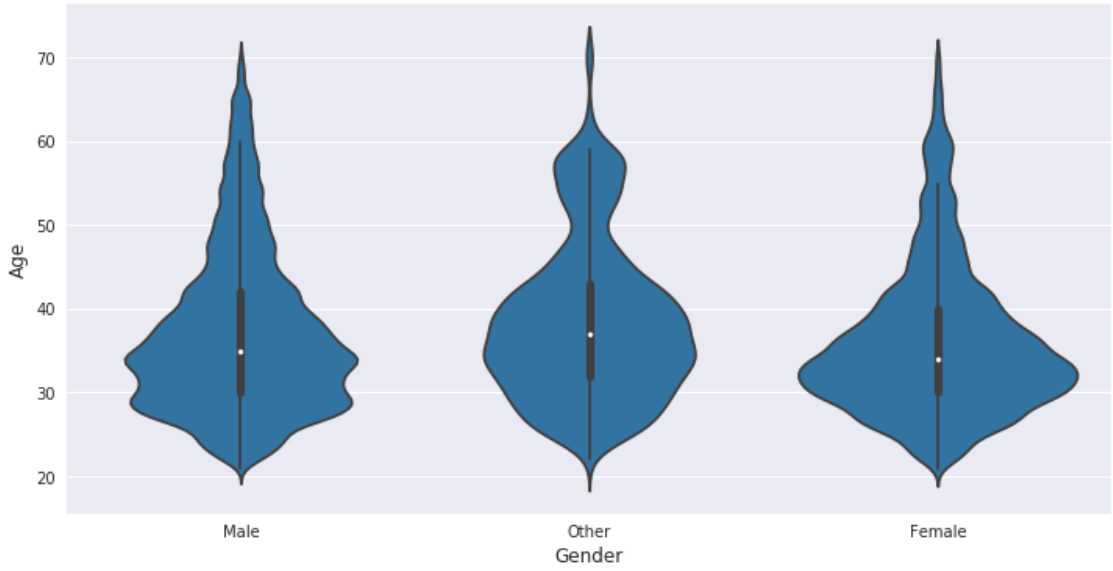
```
In [59]: # Review the relation between User Type and Member Gender
         plt.figure(figsize=[12,6])
         sb.set(style='darkgrid')
         sb.countplot(x=gobike.user_type, hue='member_gender', data=gobike)
         plt.xlabel(' User Type according to Gender', size=16);
```



In this chart the most of bike user is male gender and most of them are subscriber.

1.5.4 Is there any difference between the age of bike users and the different gender?

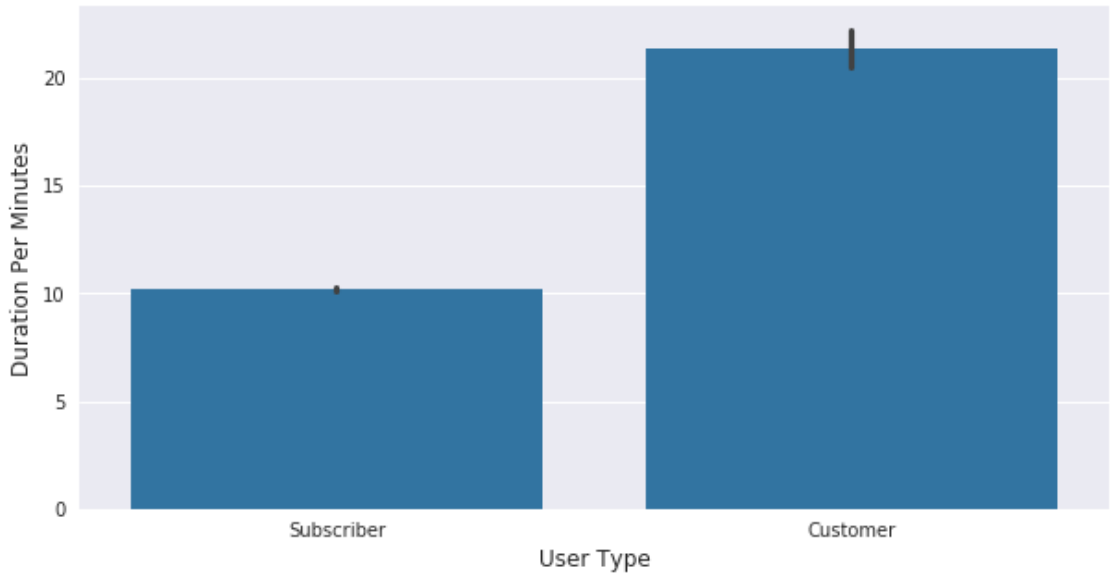
```
In [57]: # Review the relation between Age and Gender
         plt.figure(figsize=[12,6])
         sb.violinplot(data=gobike, x='member_gender', y='age', color=color, size=15)
         plt.xlabel('Gender', size=12)
         plt.ylabel('Age', size=12);
```



As we see, There is not a huge difference average age between Male and Female, but a little high for Other.

1.5.5 Which of user type has the long trip duration?

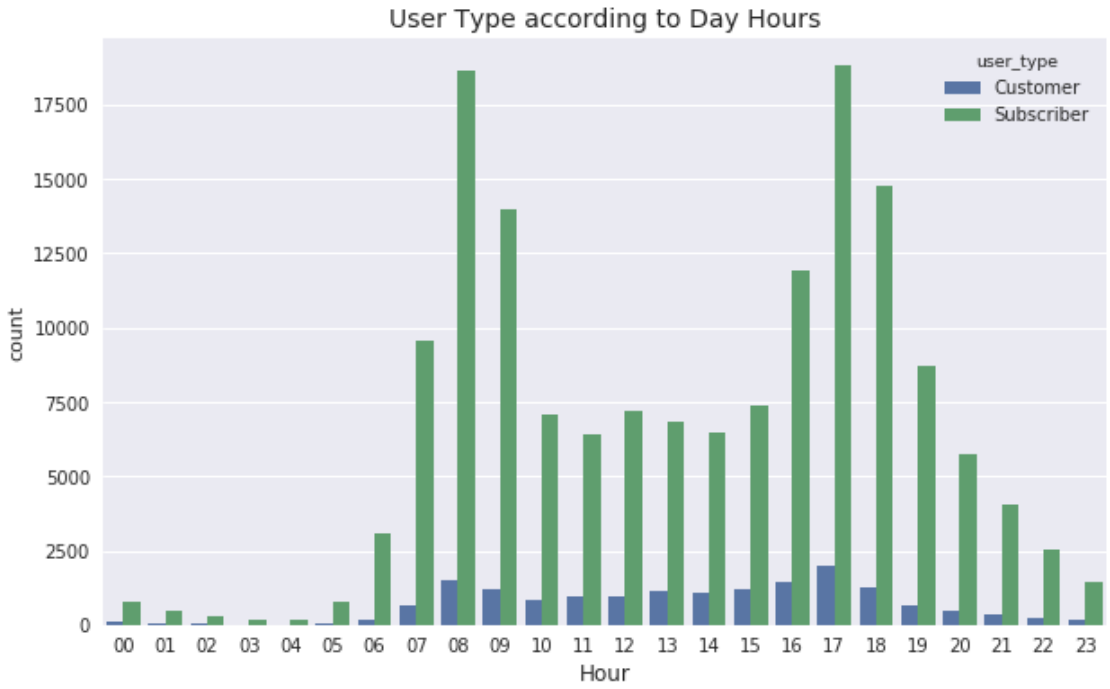
```
In [56]: # Checking the distripution trip duration per minutes according to user type
         plt.figure(figsize=[10,5])
         bike_type = gobike.user_type.value_counts().index
         sb.barplot(y='duration_min', x='user_type', data=gobike,color=color,order=bike_type)
         plt.xlabel('User Type',size=12)
         plt.ylabel('Duration Per Minutes', size=12);
```



As we see clearly, the Customer bike user spend more time than Subscriber user.

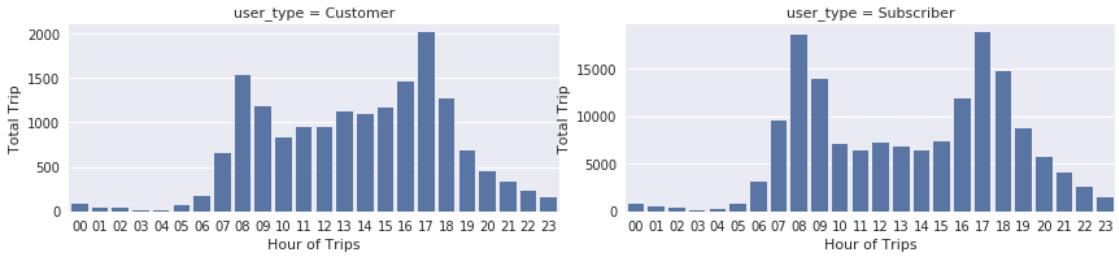
1.5.6 What is the peak time for each user type during the hours of the day?

```
In [69]: # Review the User Type Vs. Trip day hours
         plt.figure(figsize=[10,6])
         sb.countplot(x=gobike.trip_hour, hue='user_type', data=gobike)
         plt.xlabel('Hour', size=12)
         plt.title('User Type according to Day Hours', size=14);
```



In [85]:
```
# Review the relations beteeum User type and Hour of Trips separately to be more clear
i = sb.FacetGrid(data=gobike,col='user_type',col_wrap=2,aspect=2,sharey=False)
i.map(sb.countplot,'trip_hour')
for v in range(2):
    i.axes[v].set_xlabel('Hour of Trips')
    i.axes[v].set_ylabel('Total Trip');
```

```
/opt/conda/lib/python3.6/site-packages/seaborn/axisgrid.py:703: UserWarning: Using the countplot
  warnings.warn(warning)
```



Subscriber bike users seem to have lower trips between 10 AM till 3 PM, and Customer bike users seem to have higher trips than Subscriber users during the same hours.

1.5.7 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?

The number of subscriber user type is larger than Customer user type, but on another side, the Customer users spend more time on the ride than Sunscriber user.

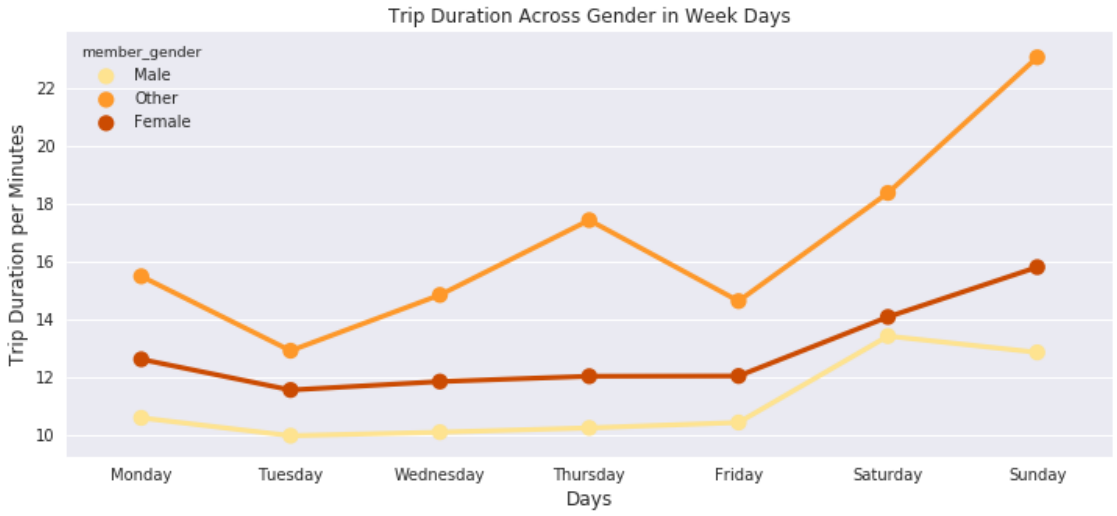
1.5.8 Did you observe any interesting relationships between the other features (not the main feature(s) of interest)?

Subscriber bike users seem to have lower trips between 10 AM till 3 PM, and Customer bike users seem to have higher trips than Subscriber users during the same hours.

1.6 Multivariate Exploration

1.6.1 Which gender has the longest trips duration during the weekdays?

```
In [98]: # Review the relation between Gender and Duration per minutes during the Weekdays
         plt.figure(figsize=[12,5])
         sb.pointplot(data=gobike, x='trip_day', y='duration_min', hue='member_gender', palette=
         plt.xlabel('Days', size=12)
         plt.ylabel('Trip Duration per Minutes', size=12)
         plt.title('Trip Duration Across Gender in Week Days', size=12);
```

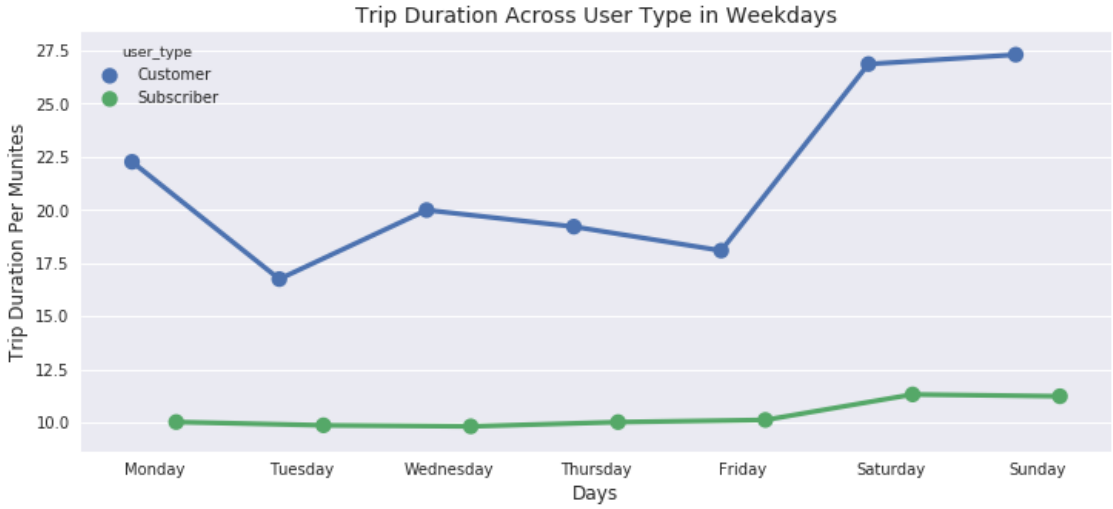


The Other gender in general tend to have much longer trips, especially on the weekend (Sat & Sun) and the second is Female.

1.6.2 Which is the user type that has the longest duration of trips during the weekdays?

```
In [106]: # Review The Trip Duration in Weekdays between Subscriber and Customer
          plt.figure(figsize=[12,5])
          sb.pointplot(data=gobike, x='trip_day', y='duration_min', hue='user_type', dodge=0.3,
```

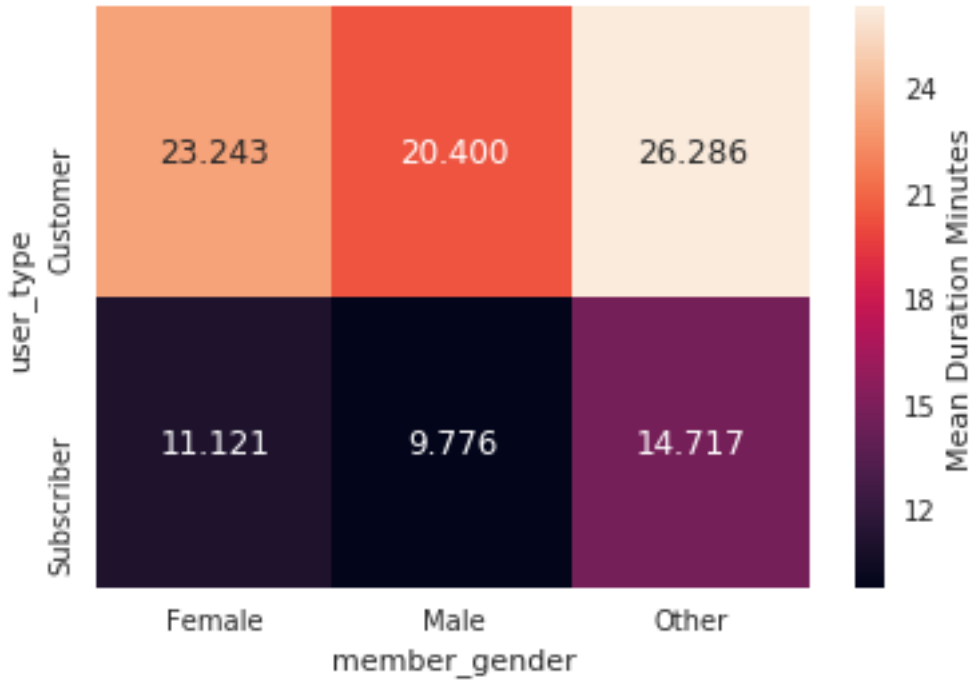
```
plt
plt.xlabel('Days', size=12)
plt.ylabel('Trip Duration Per Munites', size=12)
plt.title('Trip Duration Across User Type in Weekdays', size=14);
```



As we see, The Customer user type tend to have much longer trips, especially on the weekend (Sat & Sun).

1.6.3 What are the highest and lowest average trip duration for each user type and gender?

In [124]:
```
# Review the heatmap to display the average duration trips for each user type and gend
means = gobike.groupby(['user_type', 'member_gender']).mean()['duration_min']
means = means.reset_index(name='bike_id')
means = means.pivot(index='user_type', columns='member_gender', values='bike_id')
sb.heatmap(means,annot=True,fmt='.3f',cbar_kws={'label':'Mean Duration Minutes'});
```



The Other gender (Customer user type) has the highest average (26,286)mins and the lowest for Male gender (Subscriber user type) with (9.776)mins.

1.6.4 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 Other gender in general tend to have much longer trips, especially on the weekend (Sat & Sun) and the second is Female, and The Customer user type tend to have much longer trips, especially on the weekend (Sat & Sun).

1.6.5 Were there any interesting or surprising interactions between features?

the intersting featuers in the Male gender subscriber user type has the lowest average duration munites.

1.7 Conclusions

There are two types of clients using bikes on daily basis (Subscriber 'Members' and Customer 'Casual') and the most user type is Subscriber and most of the Subscriber is Male gender with common ages between 30 to 40.

The Peak time is in the morning between 7 Am to 8 AM and in the evening between 5 PM to 6 PM.

The Customer user type spends more time on trips especially the Other gender unlike Subscriber user type male gender.

The middle of week increases the demand for bike user, unlike the weekend.

In [ ]: