In [1]:
```
#importing necessary modules
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
```

In [2]:
```
df=pd.read_csv("file.csv")   # importing dataset
```

In [3]:
```
df.head()
```

Out[3]:

	START_DATE*	END_DATE*	CATEGORY*	START*	STOP*	MILES*	PURPOSE*
0	1/1/2016 21:11	1/1/2016 21:17	Business	Fort Pierce	Fort Pierce	5.1	Meal/Entertain
1	1/2/2016 1:25	1/2/2016 1:37	Business	Fort Pierce	Fort Pierce	5.0	NaN
2	1/2/2016 20:25	1/2/2016 20:38	Business	Fort Pierce	Fort Pierce	4.8	Errand/Supplies
3	1/5/2016 17:31	1/5/2016 17:45	Business	Fort Pierce	Fort Pierce	4.7	Meeting
4	1/6/2016 14:42	1/6/2016 15:49	Business	Fort Pierce	West Palm Beach	63.7	Customer Visit

In [4]:
```
df.tail()
```

Out[4]:

	START_DATE*	END_DATE*	CATEGORY*	START*	STOP*	MILES*	PURPOSE*
1151	12/31/2016 13:24	12/31/2016 13:42	Business	Kar?chi	Unknown Location	3.9	Temporary Site
1152	12/31/2016 15:03	12/31/2016 15:38	Business	Unknown Location	Unknown Location	16.2	Meeting
1153	12/31/2016 21:32	12/31/2016 21:50	Business	Katunayake	Gampaha	6.4	Temporary Site
1154	12/31/2016 22:08	12/31/2016 23:51	Business	Gampaha	Ilukwatta	48.2	Temporary Site
1155	Totals	NaN	NaN	NaN	NaN	12204.7	NaN

In [5]:
```
df.columns
```

Out[5]:
```
Index(['START_DATE*', 'END_DATE*', 'CATEGORY*', 'START*', 'STOP*', 'MILES*',
       'PURPOSE*'],
      dtype='object')
```

In [6]:
```
df.shape
```

Out[6]:
```
(1156, 7)
```

In [7]:
```
df.isnull().sum()  #checking for total Null values
```

Out[7]:
```
START_DATE*      0
END_DATE*        1
CATEGORY*        1
START*           1
STOP*            1
MILES*           0
PURPOSE*       503
dtype: int64
```

In [8]:
```
df[df.duplicated()]  #checking for Duplicated values
```

Out[8]:

	START_DATE*	END_DATE*	CATEGORY*	START*	STOP*	MILES*	PURPOSE*
492	6/28/2016 23:34	6/28/2016 23:59	Business	Durham	Cary	9.9	Meeting

In [9]:
```
df.drop_duplicates(inplace=True)    #Removing Duplicated values
```

In [10]:
```
df.drop(df.index[[492,491,751,761,798,807]],inplace=True)    # Removing values with same Start time and stop time
```

In [11]:
```
df["START_DATE*"]=pd.to_datetime(df["START_DATE*"],errors="coerce")
df["END_DATE*"]=pd.to_datetime(df["END_DATE*"],errors="coerce")
```

In [12]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1149 entries, 0 to 1155
Data columns (total 7 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   START_DATE*  1148 non-null   datetime64[ns]
 1   END_DATE*    1148 non-null   datetime64[ns]
 2   CATEGORY*    1148 non-null   object
 3   START*       1148 non-null   object
 4   STOP*        1148 non-null   object
 5   MILES*       1149 non-null   float64
 6   PURPOSE*     651 non-null    object
dtypes: datetime64[ns](2), float64(1), object(4)
memory usage: 71.8+ KB
```

In [13]:
```
df.head()
```

Out[13]:

	START_DATE*	END_DATE*	CATEGORY*	START*	STOP*	MILES*	PURPOSE*
0	2016-01-01 21:11:00	2016-01-01 21:17:00	Business	Fort Pierce	Fort Pierce	5.1	Meal/Entertain
1	2016-01-02 01:25:00	2016-01-02 01:37:00	Business	Fort Pierce	Fort Pierce	5.0	NaN
2	2016-01-02 20:25:00	2016-01-02 20:38:00	Business	Fort Pierce	Fort Pierce	4.8	Errand/Supplies
3	2016-01-05 17:31:00	2016-01-05 17:45:00	Business	Fort Pierce	Fort Pierce	4.7	Meeting
4	2016-01-06 14:42:00	2016-01-06 15:49:00	Business	Fort Pierce	West Palm Beach	63.7	Customer Visit

In [14]:
```
df.columns=['START_DATE','END_DATE','CATEGORY','START','STOP','MILES','PURPOSE']  #renaming columns
```

In [14]:
```
df.columns=['START_DATE','END_DATE','CATEGORY','START','STOP','MILES','PURPOSE']  #renaming columns
```

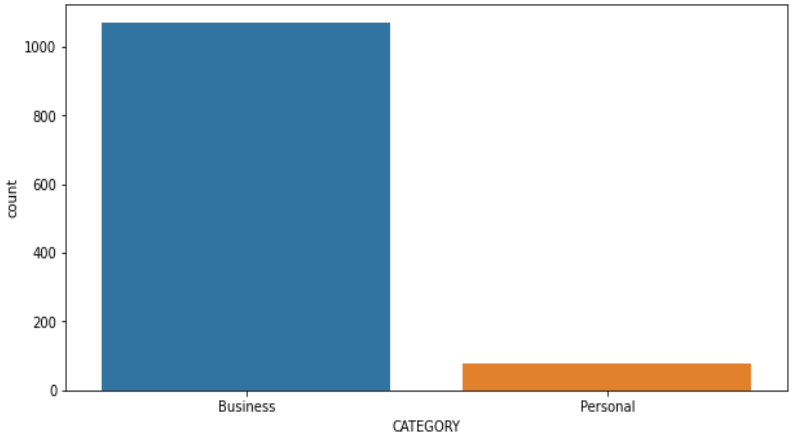
In [15]:
```
df.head()
```

Out[15]:

	START_DATE	END_DATE	CATEGORY	START	STOP	MILES	PURPOSE
0	2016-01-01 21:11:00	2016-01-01 21:17:00	Business	Fort Pierce	Fort Pierce	5.1	Meal/Entertain
1	2016-01-02 01:25:00	2016-01-02 01:37:00	Business	Fort Pierce	Fort Pierce	5.0	NaN
2	2016-01-02 20:25:00	2016-01-02 20:38:00	Business	Fort Pierce	Fort Pierce	4.8	Errand/Supplies
3	2016-01-05 17:31:00	2016-01-05 17:45:00	Business	Fort Pierce	Fort Pierce	4.7	Meeting
4	2016-01-06 14:42:00	2016-01-06 15:49:00	Business	Fort Pierce	West Palm Beach	63.7	Customer Visit

In [16]:
```
#count plot
plt.figure(figsize=(10,5))
sns.countplot(df['CATEGORY'])
```

Out[16]: <Axes: xlabel='CATEGORY', ylabel='count'>



In [17]:
```
start_labels=df.START.value_counts().nlargest(10)
start_labels
```

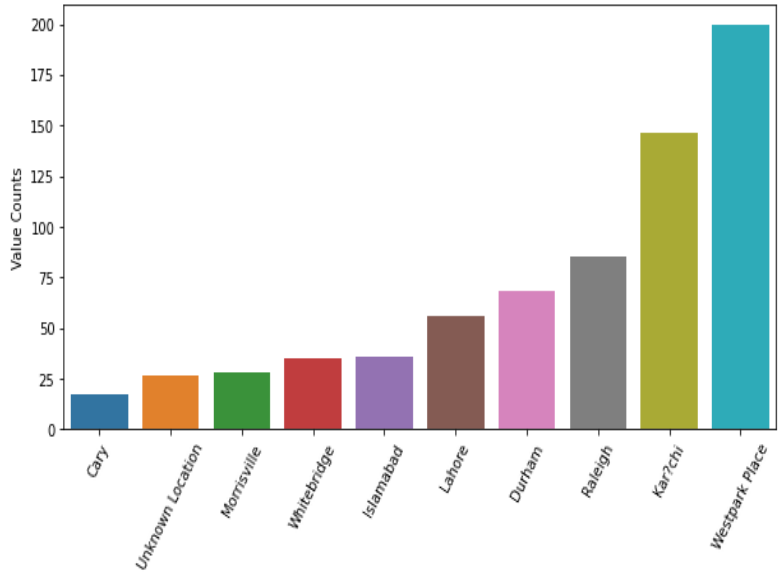
Out[17]:
```
Cary               200
Unknown Location   146
Morrisville         85
Whitebridge         68
Islamabad           56
Lahore              36
Durham              35
Raleigh             28
Kar?chi             27
Westpark Place      17
Name: START, dtype: int64
```

In [18]:
```
stop_labels = df.STOP.value_counts().nlargest(10)
stop_labels
```

Out[18]:
```
Cary               201
Unknown Location   146
Morrisville         83
Whitebridge         65
Islamabad           57
Durham              36
Lahore              36
Raleigh             29
Kar?chi             26
Apex                17
Name: STOP, dtype: int64
```

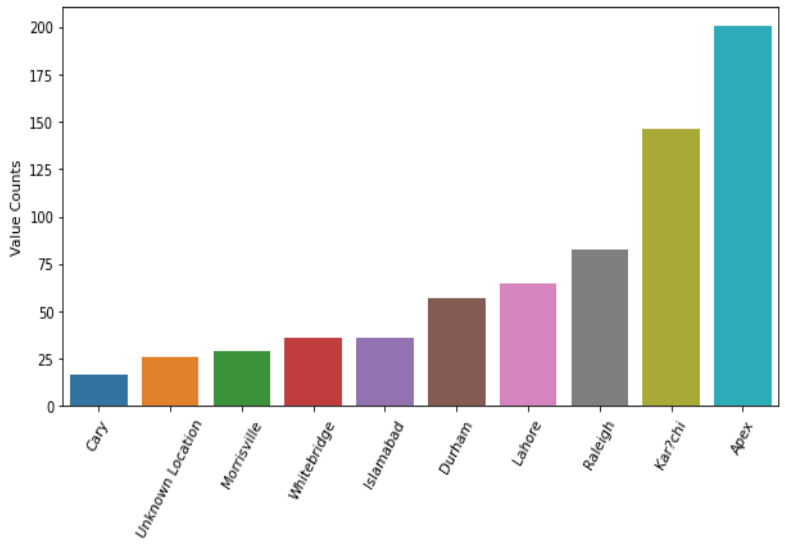
In [19]:
```
plt.figure(figsize=(10,5))
plt.xticks(rotation=60)
sns.barplot(start_labels.index,sorted(start_labels))
plt.ylabel('Value Counts')
```

Out[19]:
```
Text(0, 0.5, 'Value Counts')
```



In [20]:
```
plt.figure(figsize=(10,5))
plt.xticks(rotation=60)
sns.barplot(stop_labels.index,sorted(stop_labels))
plt.ylabel('Value Counts')
```

Out[20]:
```
Text(0, 0.5, 'Value Counts')
```



In [21]:
```
df['MONTH']=pd.DatetimeIndex(df['START_DATE']).month
df['MONTH']
```

Out[21]:
```
0        1.0
1        1.0
2        1.0
3        1.0
4        1.0
        ...
1151    12.0
1152    12.0
1153    12.0
1154    12.0
1155     NaN
Name: MONTH, Length: 1149, dtype: float64
```

In [22]:
```
month_labels={1.0:"Jan",2.0:'Feb',3.0:'March',4.0:'April',5.0:"May",6.0:'June',7.0:"July",8.0:'August',9.0:"Sept",
              10.0:'Oct',11.0:'Nov',12.0:'DEc'}
```

In [23]:
```
df["MONTH"]=df.MONTH.map(month_labels)
df['MONTH'].unique()
```

Out[23]:
```
array(['Jan', 'Feb', 'March', 'April', 'May', 'June', 'July', 'August',
       'Sept', 'Oct', 'Nov', 'DEc', nan], dtype=object)
```

In [24]:
```
df.head()
```

Out[24]:

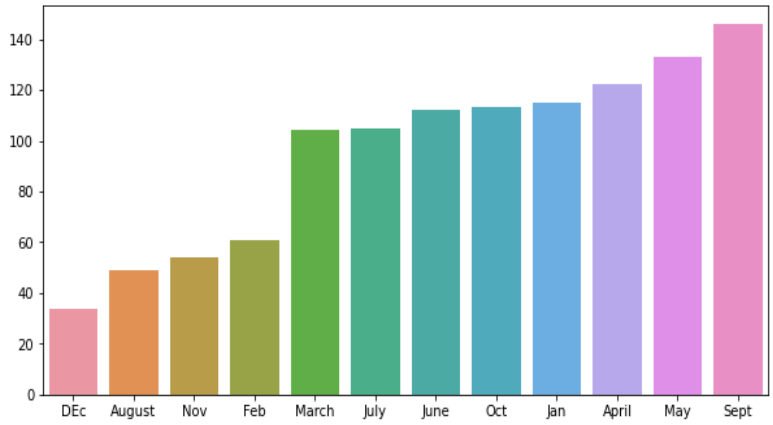
	START_DATE	END_DATE	CATEGORY	START	STOP	MILES	PURPOSE	MONTH
0	2016-01-01 21:11:00	2016-01-01 21:17:00	Business	Fort Pierce	Fort Pierce	5.1	Meal/Entertain	Jan
1	2016-01-02 01:25:00	2016-01-02 01:37:00	Business	Fort Pierce	Fort Pierce	5.0	NaN	Jan
2	2016-01-02 20:25:00	2016-01-02 20:38:00	Business	Fort Pierce	Fort Pierce	4.8	Errand/Supplies	Jan
3	2016-01-05 17:31:00	2016-01-05 17:45:00	Business	Fort Pierce	Fort Pierce	4.7	Meeting	Jan
4	2016-01-06 14:42:00	2016-01-06 15:49:00	Business	Fort Pierce	West Palm Beach	63.7	Customer Visit	Jan

In [25]:
```
month_count=df.MONTH.value_counts()
month_count
```

Out[25]:
```
DEc       146
August    133
Nov       122
Feb       115
March     113
July      112
June      105
Oct       104
Jan        61
April      54
May        49
Sept       34
Name: MONTH, dtype: int64
```

In [26]:
```
plt.figure(figsize=(10,5))
sns.barplot(month_count.index,sorted(month_count))
```

Out[26]:
```
<Axes: >
```



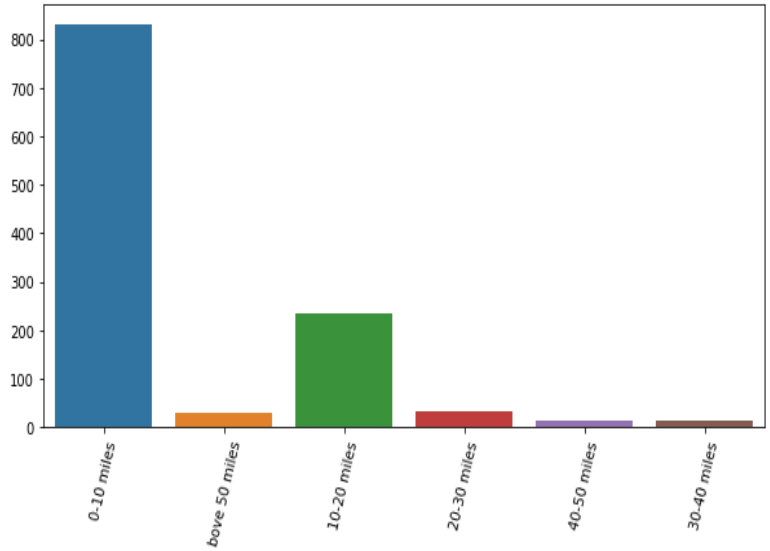
In [27]:
```
miles={}
for i in df.MILES:
    if i<10:
        if '0-10 miles' not in miles:
            miles["0-10 miles"]= [i]
        else:
            miles['0-10 miles'].append(i)
    elif i>=10 and i<20:
        if "10-20 miles" not in miles:
            miles['10-20 miles']=[i]
        else:
            miles['10-20 miles'].append(i)
    elif i>=20 and i<30:
        if "20-30 miles" not in miles:
            miles['20-30 miles']=[i]
        else:
            miles['20-30 miles'].append(i)
    elif i>=30 and i<40:
        if "30-40 miles" not in miles:
            miles['30-40 miles']=[i]
        else:
            miles['30-40 miles'].append(i)
    elif i>=40 and i<50:
        if "40-50 miles" not in miles:
            miles['40-50 miles']=[i]
        else:
            miles['40-50 miles'].append(i)
    else:
        if "Above 50 miles" not in miles:
            miles['Above 50 miles']=[i]
        else:
            miles['Above 50 miles'].append(i)
```

In [28]:
```
len_miles=[]
for key in miles:
    len_miles.append((key,len(miles[key])))
```

In [29]:
```
a,b=[],[]
for i,j in len_miles:
    a.append(i)
    b.append(j)
```

In [30]:
```
plt.figure(figsize=(10,5))
plt.xticks(rotation=75)
sns.barplot(a,b)
```

Out[30]: <Axes: >



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

Out[31]:

	START_DATE	END_DATE	CATEGORY	START	STOP	MILES	PURPOSE	MONTH
0	2016-01-01 21:11:00	2016-01-01 21:17:00	Business	Fort Pierce	Fort Pierce	5.1	Meal/Entertain	Jan
1	2016-01-02 01:25:00	2016-01-02 01:37:00	Business	Fort Pierce	Fort Pierce	5.0	NaN	Jan
2	2016-01-02 20:25:00	2016-01-02 20:38:00	Business	Fort Pierce	Fort Pierce	4.8	Errand/Supplies	Jan
3	2016-01-05 17:31:00	2016-01-05 17:45:00	Business	Fort Pierce	Fort Pierce	4.7	Meeting	Jan
4	2016-01-06 14:42:00	2016-01-06 15:49:00	Business	Fort Pierce	West Palm Beach	63.7	Customer Visit	Jan

In [32]:
```
time=pd.to_datetime(["18:00:00"]).time
```

In [33]:
```
def check_time(tim):
    if time>tim:
        tim='DAY RIDE'
    else:
        tim="NIGHT RIDE"
```

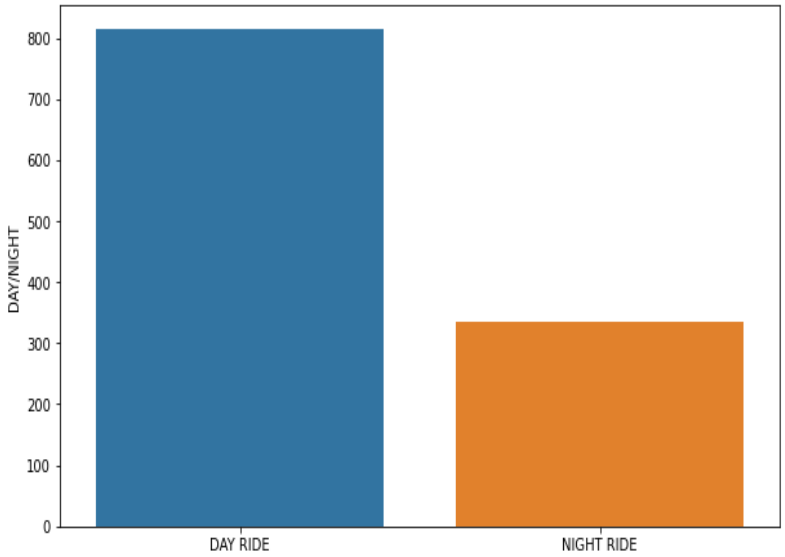
In [34]:
```
df['DAY/NIGHT']=df.apply(lambda x: 'NIGHT RIDE' if pd.notna(x['START_DATE']) and pd.Timestamp(x['START_DATE']).time() > time
                         else 'DAY RIDE',axis=1)
```

In [35]:
```
day_night=df['DAY/NIGHT'].value_counts()
day_night
```

Out[35]:
```
DAY RIDE      814
NIGHT RIDE    335
Name: DAY/NIGHT, dtype: int64
```

In [36]:
```
plt.figure(figsize=(10,6))
sns.barplot(day_night.index,day_night)
```

Out[36]: <Axes: ylabel='DAY/NIGHT'>



In [37]:
```
df['DAY']=df.START_DATE.dt.weekday
```

In [38]:
```
day_label={0.0:'Monday',1.0:'Tuesday',2.0:'Wednessday',3.0:'Thursday',4.0:'Friday',5.0:'Saturday',6.0:'Sunday'}
df['DAY']=df['DAY'].map(day_label)
```

In [39]:
```
day=df.DAY.value_counts()
day
```

Out[39]:
```
Friday       206
Tuesday      174
Monday       174
Thursday     153
Saturday     148
Sunday       147
Wednessday   146
Name: DAY, dtype: int64
```

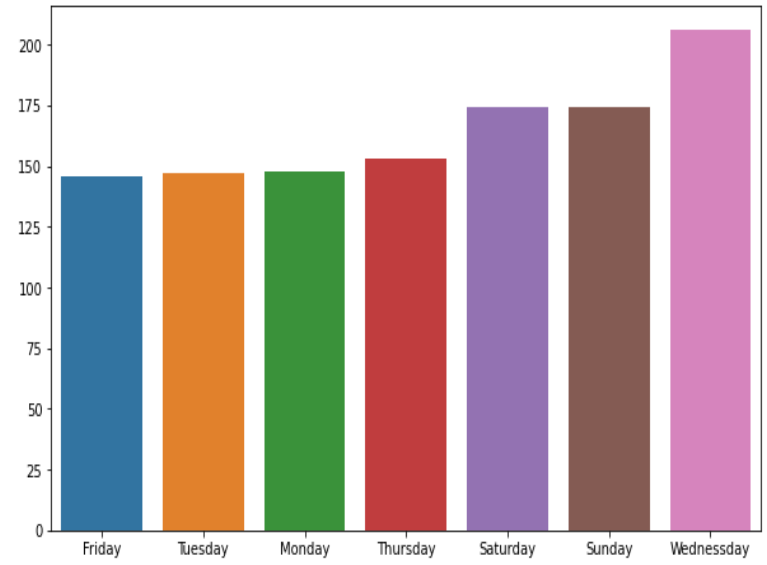
In [40]:
```
df.head()
```

Out[40]:

	START_DATE	END_DATE	CATEGORY	START	STOP	MILES	PURPOSE	MONTH	DAY/NIGHT	DAY
0	2016-01-01 21:11:00	2016-01-01 21:17:00	Business	Fort Pierce	Fort Pierce	5.1	Meal/Entertain	Jan	NIGHT RIDE	Friday
1	2016-01-02 01:25:00	2016-01-02 01:37:00	Business	Fort Pierce	Fort Pierce	5.0	NaN	Jan	DAY RIDE	Saturday
2	2016-01-02 20:25:00	2016-01-02 20:38:00	Business	Fort Pierce	Fort Pierce	4.8	Errand/Supplies	Jan	NIGHT RIDE	Saturday
3	2016-01-05 17:31:00	2016-01-05 17:45:00	Business	Fort Pierce	Fort Pierce	4.7	Meeting	Jan	DAY RIDE	Tuesday
4	2016-01-06 14:42:00	2016-01-06 15:49:00	Business	Fort Pierce	West Palm Beach	63.7	Customer Visit	Jan	DAY RIDE	Wednessday

In [42]:
```
plt.figure(figsize=(10,6))
sns.barplot(day.index,sorted(day))
```

Out[42]: <Axes: >



In [43]:
```
plt.figure(figsize=(10,6))
sns.countplot(hue='CATEGORY' ,x ='DAY' , data=df)
```

Out[43]: <Axes: xlabel='DAY', ylabel='count'>