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Assignment: Week 3 Assignment 3.2

Date: June 27, 2021

Description: I would like you to determine what night would be the best to run a marketing promotion to increase attendance. It is up to you if you decide to recommend a specific date or if you recommend a day of the week (e.g., Tuesdays) or month and day of the week (e.g., July Tuesdays).

In [1]:
```
#Load common libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:
```
#Read the file and move to dataframe
file = "dodger.csv"
df_dodger = pd.read_csv(file)
```

In [3]:
```
print("The dimension of the table is: ", df_dodger.shape)
```

```
The dimension of the table is:  (81, 12)
```

In [4]:
```
print(df_dodger.head(5))
```

```
  month  day  attend day_of_week opponent  temp   skies day_night cap
shirt  \
0   APR   10   56000     Tuesday  Pirates    67  Clear        Day  NO
NO
1   APR   11   29729   Wednesday  Pirates    58  Cloudy     Night  NO
NO
2   APR   12   28328    Thursday  Pirates    57  Cloudy     Night  NO
NO
3   APR   13   31601      Friday   Padres    54  Cloudy     Night  NO
NO
4   APR   14   46549    Saturday   Padres    57  Cloudy     Night  NO
NO

  fireworks bobblehead
0        NO         NO
1        NO         NO
2        NO         NO
3       YES         NO
4        NO         NO
```

In [5]:
```
print("Describe Data")
print(df_dodger.describe())
```

```
Describe Data
              day        attend       temp
count  81.000000     81.000000  81.000000
mean   16.135802  41040.074074  73.148148
std     9.605666   8297.539460   8.317318
min     1.000000  24312.000000  54.000000
25%     8.000000  34493.000000  67.000000
50%    15.000000  40284.000000  73.000000
75%    25.000000  46588.000000  79.000000
max    31.000000  56000.000000  95.000000
```

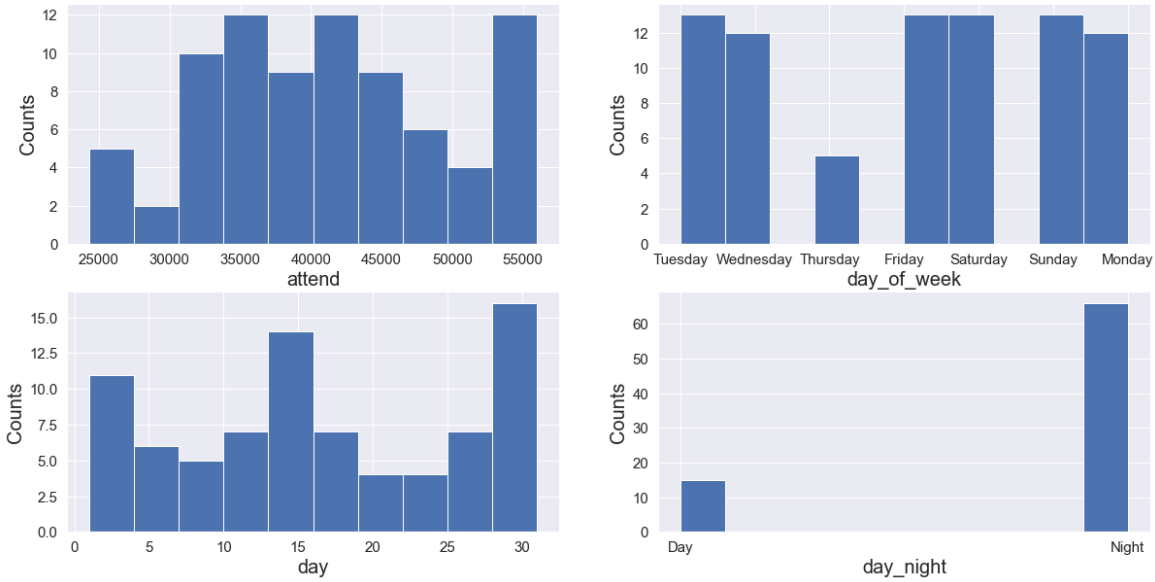
In [6]:
```
print("Summarized Data")
print(df_dodger.describe(include=['O']))
```

```
Summarized Data
       month day_of_week opponent   skies day_night cap shirt firewor
ks  \
count     81          81       81      81        81  81    81
81
unique     7           7       17       2         2   2     2
2
top      MAY    Saturday   Snakes  Clear      Night  NO    NO
NO
freq      18          13        9      62        66  79    78
67

       bobblehead
count          81
unique          2
top            NO
freq           70
```

In [11]:
```
df_dodger.columns
```

Out[11]:
```
Index(['month', 'day', 'attend', 'day_of_week', 'opponent', 'temp', '
skies',
       'day_night', 'cap', 'shirt', 'fireworks', 'bobblehead'],
      dtype='object')
```

In [16]:
```
# set up the figure size
plt.rcParams['figure.figsize'] = (20, 10)

# make subplots
fig, axes = plt.subplots(nrows = 2, ncols = 2)

# Specify the features of interest
num_features = ['attend', 'day_of_week', 'day','day_night']
xaxes = num_features
yaxes = ['Counts', 'Counts', 'Counts', 'Counts']

# draw histograms
axes = axes.ravel()
for idx, ax in enumerate(axes):
    ax.hist(df_dodger[num_features[idx]].dropna(), bins=10)
    ax.set_xlabel(xaxes[idx], fontsize=20)
    ax.set_ylabel(yaxes[idx], fontsize=20)
    ax.tick_params(axis='both', labelsize=15)
```

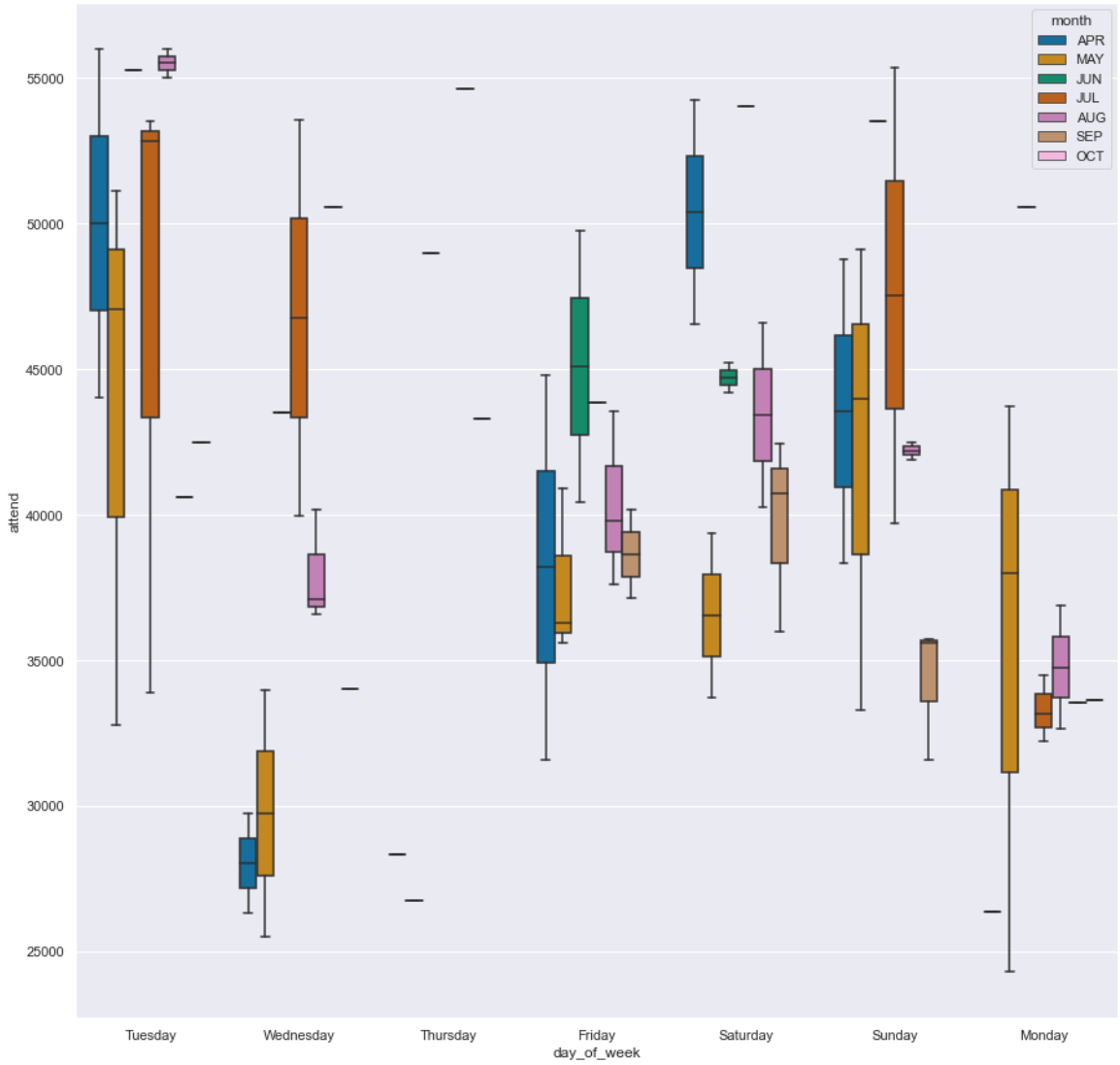


Do the following:Box plots,Scatter plots & Regression Model

In [3]:
```
#Import seaborn
import seaborn as sns
```

In [15]:
```
#boxplots
sns.set(rc={'figure.figsize':(15,15)})
sns.boxplot(y='attend', x='day_of_week',
                 data=df_dodger,
                 palette='colorblind',
                 hue='month')
```

Out[15]: <matplotlib.axes._subplots.AxesSubplot at 0x2064eb71be0>



Based on the question - I would like you to determine what night would be the best to run a marketing promotion to increase attendance.

In [4]:
```
#Make a copy for later
df_dodger_copy_0 = df_dodger.copy(deep=True)
```

In [9]:
```
#Replace string with numbers day of week
df_dodger['day_of_week'] = df_dodger['day_of_week'].replace(['Sunday','
Monday','Tuesday','Wednesday',
                                                             'Thur
sday','Friday','Saturday'],[1,2,3,

4,5,6,

7])

#Print preview
df_dodger
```

Out[9]:

	month	day	attend	day_of_week	opponent	temp	skies	day_night	cap	shirt	fireworl
0	APR	10	56000	3	Pirates	67	Clear	Day	NO	NO	N
1	APR	11	29729	4	Pirates	58	Cloudy	Night	NO	NO	N
2	APR	12	28328	5	Pirates	57	Cloudy	Night	NO	NO	N
3	APR	13	31601	6	Padres	54	Cloudy	Night	NO	NO	YE
4	APR	14	46549	7	Padres	57	Cloudy	Night	NO	NO	N
...	...	...	...	...	...	...	...	...	...	...	
76	SEP	29	40724	7	Rockies	84	Cloudy	Night	NO	NO	N
77	SEP	30	35607	1	Rockies	95	Clear	Day	NO	NO	N
78	OCT	1	33624	2	Giants	86	Clear	Night	NO	NO	N
79	OCT	2	42473	3	Giants	83	Clear	Night	NO	NO	N
80	OCT	3	34014	4	Giants	82	Cloudy	Night	NO	NO	N

81 rows × 12 columns

In [10]:
```
#Check the values of skie
df_dodger['skies'].value_counts()
```

Out[10]:
```
Clear     62
Cloudy    19
Name: skies, dtype: int64
```

In [11]:
```
#Check the values for cap
df_dodger['cap'].value_counts()
```

Out[11]:
```
NO     79
YES     2
Name: cap, dtype: int64
```

In [12]:
```
#Double check data types
df_dodger.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 81 entries, 0 to 80
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   month        81 non-null     object
 1   day          81 non-null     int64 
 2   attend       81 non-null     int64 
 3   day_of_week  81 non-null     int64 
 4   opponent     81 non-null     object
 5   temp         81 non-null     int64 
 6   skies        81 non-null     object
 7   day_night    81 non-null     object
 8   cap          81 non-null     object
 9   shirt        81 non-null     object
 10  fireworks    81 non-null     object
 11  bobblehead   81 non-null     object
dtypes: int64(4), object(8)
memory usage: 7.7+ KB
```

In [13]:
```
#Clean up the NO and YES to 0 and 1 for all values
cleanup_nums = {'skies':{'Clear ': 0, 'Cloudy': 1},
                'cap': {'NO': 0, 'YES': 1},
                'shirt':{'NO':0,'YES':1},
                'fireworks':{'NO':0,'YES':1},
                'bobblehead':{'NO':0,'YES':1}}
```

In [14]:
```
#Run the code to clean it up
df_dodger = df_dodger.replace(cleanup_nums)
#Preview what came out
df_dodger.head()
```

Out[14]:

	month	day	attend	day_of_week	opponent	temp	skies	day_night	cap	shirt	fireworks
0	APR	10	56000	3	Pirates	67	0	Day	0	0	0
1	APR	11	29729	4	Pirates	58	1	Night	0	0	0
2	APR	12	28328	5	Pirates	57	1	Night	0	0	0
3	APR	13	31601	6	Padres	54	1	Night	0	0	1
4	APR	14	46549	7	Padres	57	1	Night	0	0	0

In [15]:
```
#Check value type of skies
df_dodger['skies'].value_counts()
```

Out[15]:
```
0    62
1    19
Name: skies, dtype: int64
```

In [16]:
```
#Update data types to int
df_dodger['skies'] = df_dodger['skies'].astype('int')

#Check data types
df_dodger.dtypes
```

Out[16]:
```
month          object
day             int64
attend          int64
day_of_week     int64
opponent       object
temp            int64
skies           int32
day_night      object
cap             int64
shirt           int64
fireworks       int64
bobblehead      int64
dtype: object
```

In [17]:
```
#Check the count of values
df_dodger['day_night'].value_counts()
```

Out[17]:
```
Night    66
Day      15
Name: day_night, dtype: int64
```

In [18]:
```
#Clean up the NO and YES to 0 and 1 for all values
cleanup_dn = {'day_night':{'Night': 0, 'Day': 1}}
```

In [19]:
```
#Run the code to clean it up
df_dodger = df_dodger.replace(cleanup_dn)
#Preview what came out
df_dodger.head()
```

Out[19]:

	month	day	attend	day_of_week	opponent	temp	skies	day_night	cap	shirt	fireworks
0	APR	10	56000	3	Pirates	67	0	1	0	0	0
1	APR	11	29729	4	Pirates	58	1	0	0	0	0
2	APR	12	28328	5	Pirates	57	1	0	0	0	0
3	APR	13	31601	6	Padres	54	1	0	0	0	1
4	APR	14	46549	7	Padres	57	1	0	0	0	0

In [20]:
```
#Check data types
df_dodger.dtypes
```

Out[20]:
```
month          object
day             int64
attend          int64
day_of_week     int64
opponent       object
temp            int64
skies           int32
day_night       int64
cap             int64
shirt           int64
fireworks       int64
bobblehead      int64
dtype: object
```

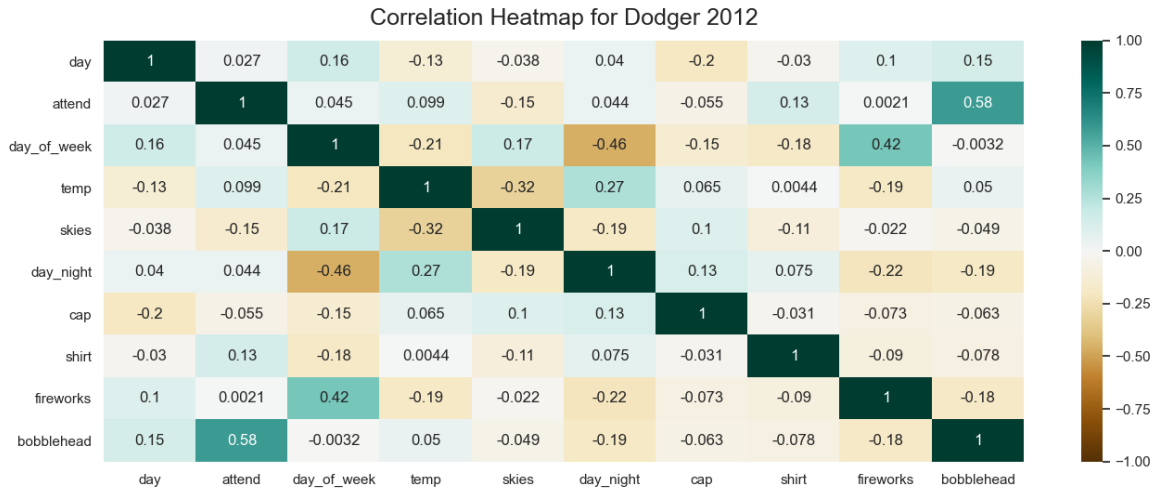
In [21]:
```
#Correlation Matrix
corr_matrix = df_dodger.corr()
```

In [22]:
```
#View the correlation Matrix
corr_matrix
```

Out[22]:

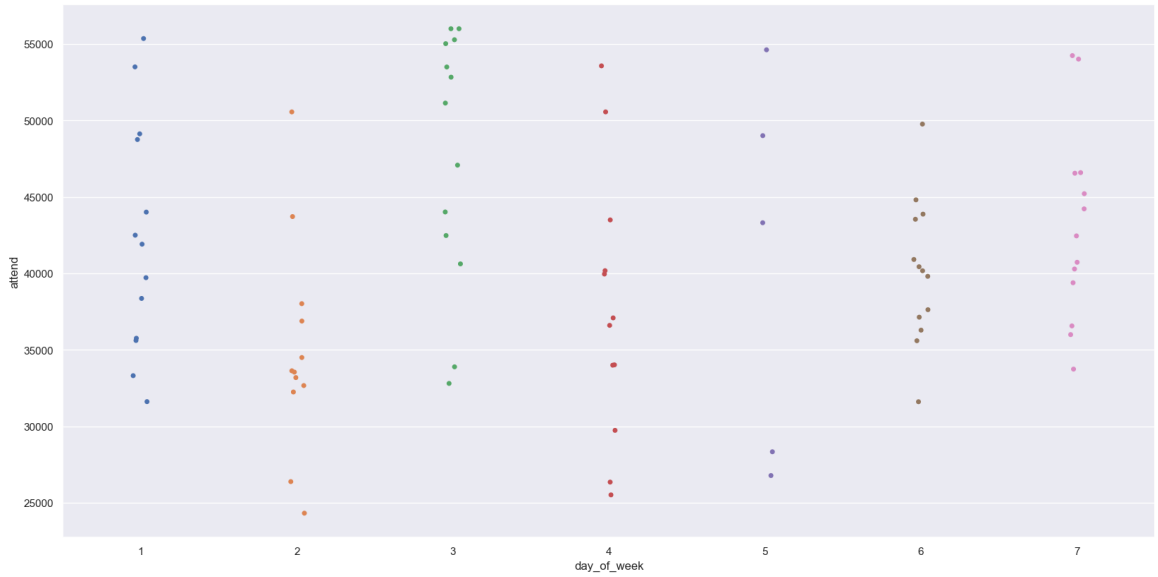
	day	attend	day_of_week	temp	skies	day_night	cap	
day	1.000000	0.027093	0.160664	-0.127612	-0.038396	0.039828	-0.202274	-(
attend	0.027093	1.000000	0.045177	0.098951	-0.150963	0.043544	-0.055002	(
day_of_week	0.160664	0.045177	1.000000	-0.210856	0.173522	-0.455972	-0.147091	-(
temp	-0.127612	0.098951	-0.210856	1.000000	-0.316584	0.272141	0.064521	(
skies	-0.038396	-0.150963	0.173522	-0.316584	1.000000	-0.188903	0.099671	-(
day_night	0.039828	0.043544	-0.455972	0.272141	-0.188903	1.000000	0.128951	(
cap	-0.202274	-0.055002	-0.147091	0.064521	0.099671	0.128951	1.000000	-(
shirt	-0.030182	0.133269	-0.181300	0.004394	-0.108566	0.074796	-0.031204	1
fireworks	0.099528	0.002094	0.423744	-0.189899	-0.021880	-0.217922	-0.072732	-(
bobblehead	0.145363	0.581895	-0.003203	0.049573	-0.049349	-0.188982	-0.063074	-(

In [80]:
```
#Visual for Heatmap Correlation
plt.figure(figsize=(16, 6))
hm=sns.heatmap(df_dodger.corr(), vmin=-1, vmax=1, annot=True, cmap='BrBG')
hm.set_title('Correlation Heatmap for Dodger 2012', fontdict={'fontsize':18}, pad=12);
```



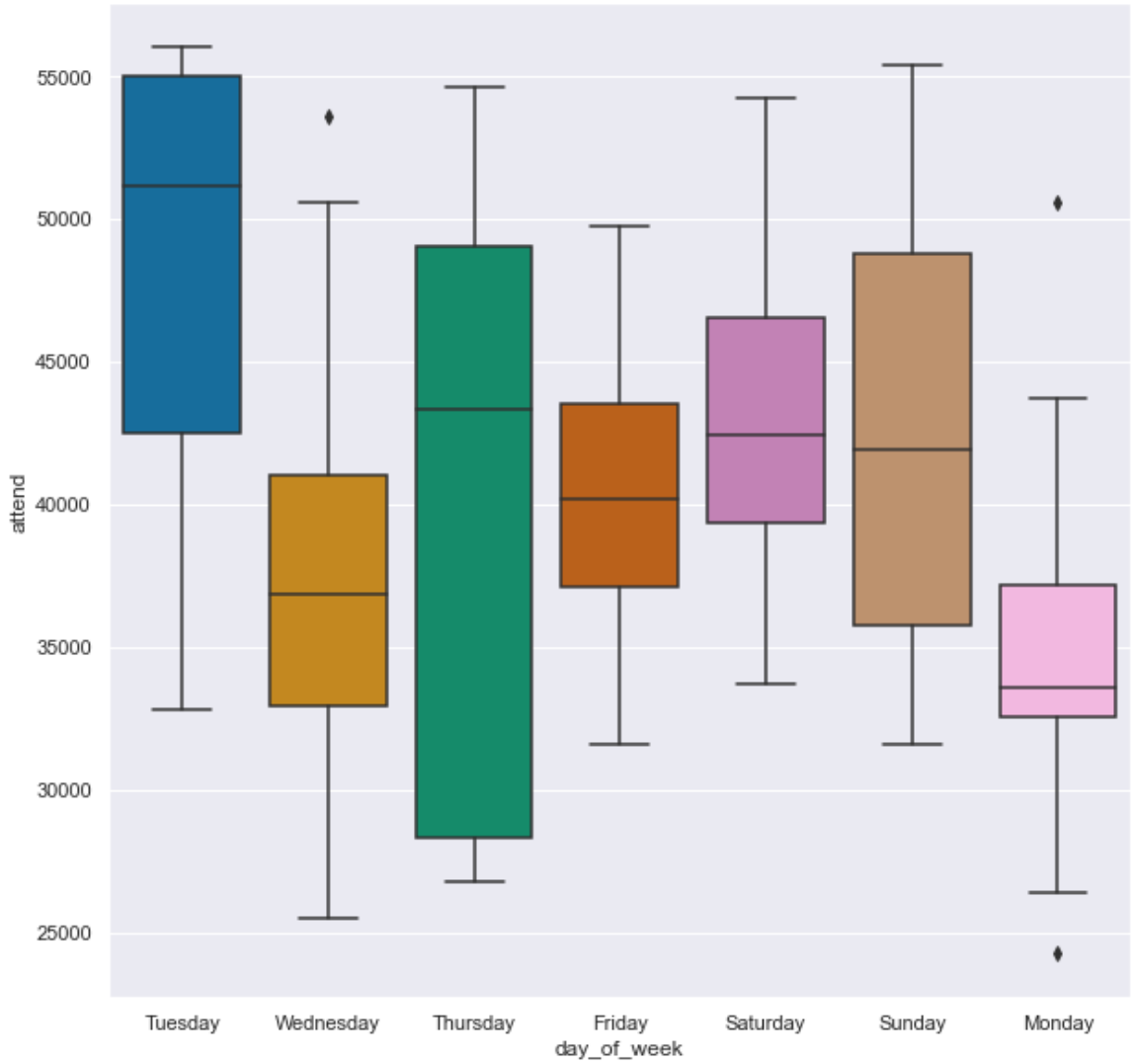
In [81]:
```
#sns.relplot(x='day_of_week', y='attend', data=df_dodger)
sns.stripplot('day_of_week', y='attend', data=df_dodger, jitter=0.05)
```

Out[81]: <matplotlib.axes._subplots.AxesSubplot at 0x206587826a0>



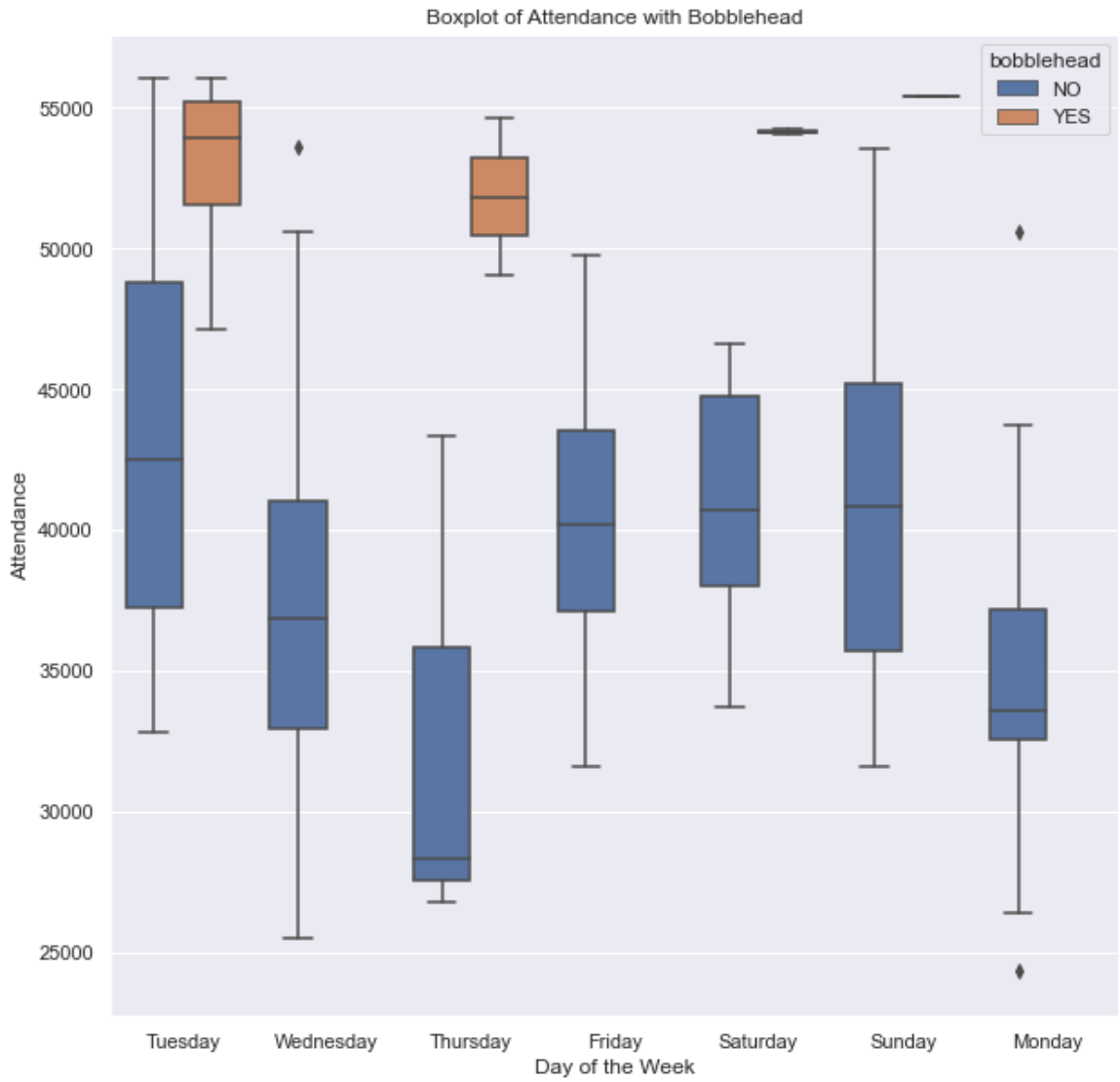
In [8]:
```
sns.set(rc={'figure.figsize':(10,10)})
sns.boxplot(y='attend', x='day_of_week',
                 data=df_dodger,
                 palette='colorblind')
```

Out[8]: <matplotlib.axes._subplots.AxesSubplot at 0x15b7639faf0>

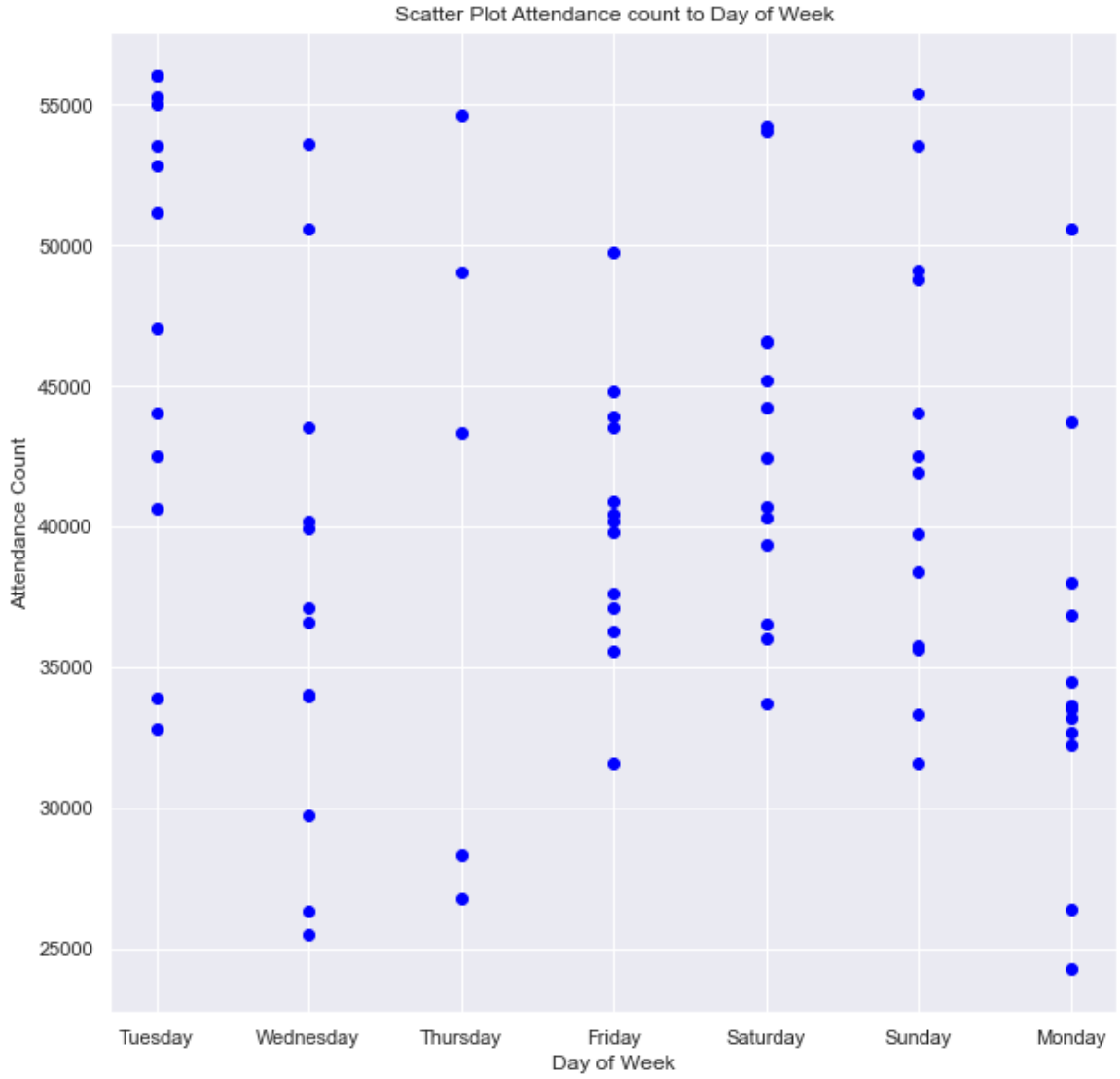


In [10]:
```
sns.set(rc={'figure.figsize':(10,10)})
sns.boxplot(y='attend', x='day_of_week',
                 data=df_dodger_copy_0,
                 hue='bobblehead').set(
    xlabel='Day of the Week',
    ylabel='Attendance',
    title='Boxplot of Attendance with Bobblehead')
```

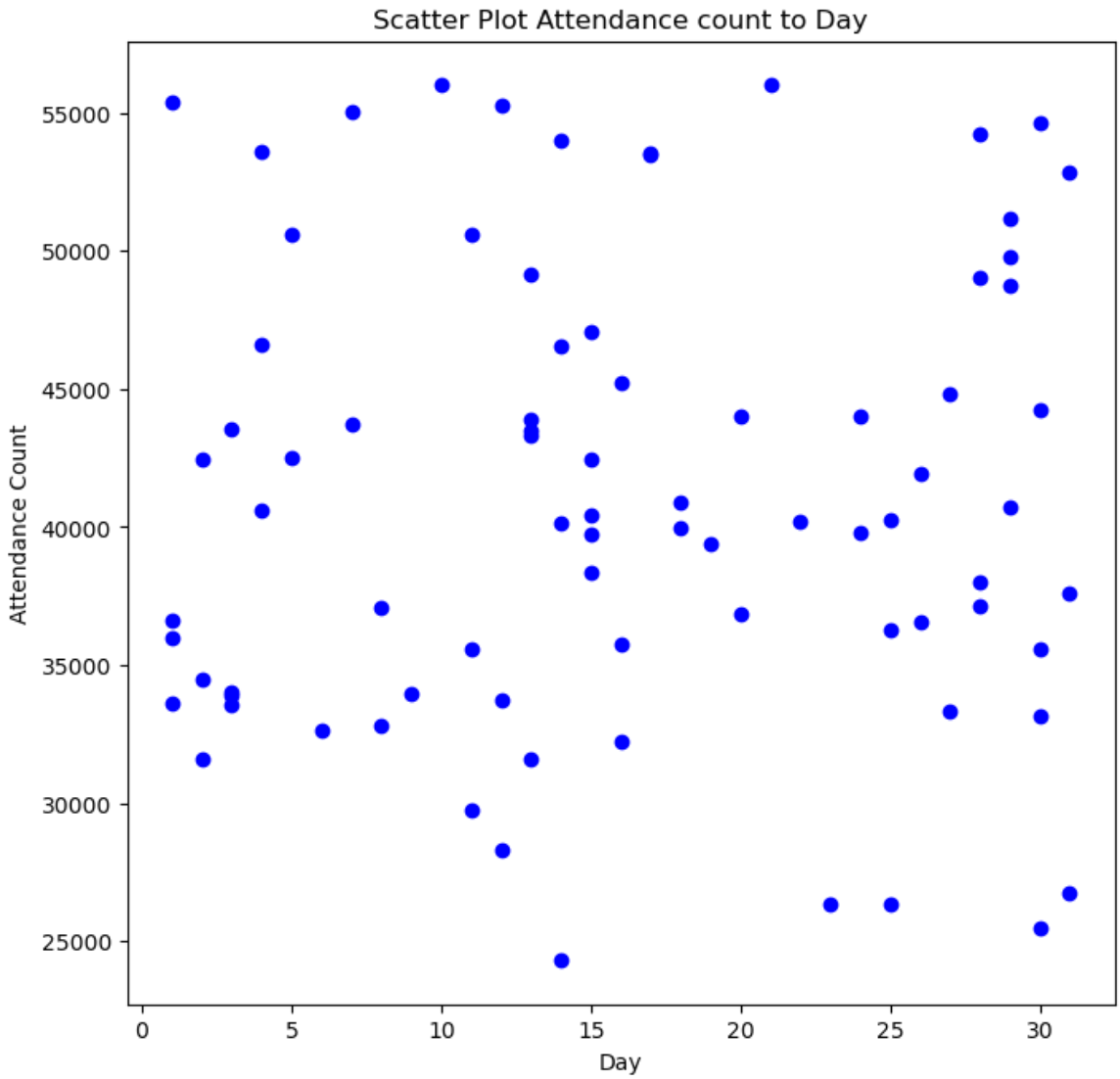
Out[10]:
```
[Text(0, 0.5, 'Attendance'),
 Text(0.5, 0, 'Day of the Week'),
 Text(0.5, 1.0, 'Boxplot of Attendance with Bobblehead')]
```



In [11]:
```
# Scatterplot - To check correlation
x = df_dodger["day_of_week"]
y = df_dodger["attend"]

# Plot
plt.scatter(x,y,color="blue")
plt.rcParams.update({"figure.figsize":(8,8), "figure.dpi":100})

#Labels
plt.title('Scatter Plot Attendance count to Day of Week')
plt.xlabel('Day of Week')
plt.ylabel('Attendance Count')
plt.show()
```



In [6]:
```
# Scatterplot - To check correlation
x = df_dodger["day"]
y = df_dodger["attend"]

# Plot
plt.scatter(x,y,color="blue")
plt.rcParams.update({"figure.figsize":(10,10), "figure.dpi":100})

#Labels
plt.title('Scatter Plot Attendance count to Day')
plt.xlabel('Day')
plt.ylabel('Attendance Count')
plt.show()
```



In [82]:
```
#Make a copy incase I need to return
df_dodger_copy_1 = df_dodger.copy(deep=True)
```

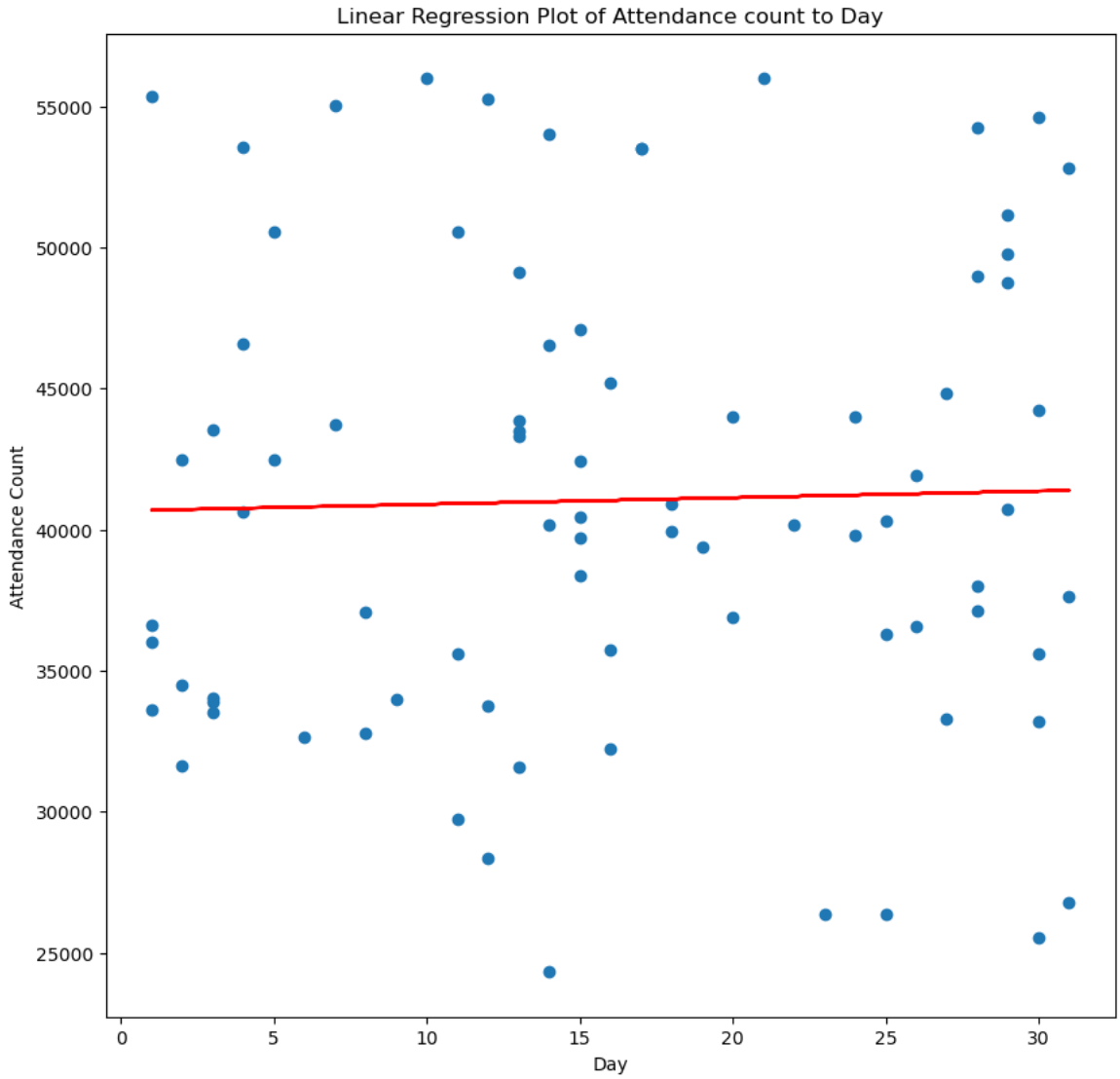
In [90]:
```
#Drop opponent
df_dodger = df_dodger.drop(['opponent'], axis=1)
df_dodger = df_dodger.drop(['month'], axis=1)
df_dodger.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 81 entries, 0 to 80
Data columns (total 10 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   day          81 non-null     int64
 1   attend       81 non-null     int64
 2   day_of_week  81 non-null     int64
 3   temp         81 non-null     int64
 4   skies        81 non-null     int32
 5   day_night    81 non-null     int64
 6   cap          81 non-null     int64
 7   shirt        81 non-null     int64
 8   fireworks    81 non-null     int64
 9   bobblehead   81 non-null     int64
dtypes: int32(1), int64(9)
memory usage: 6.1 KB
```

In [7]:
```
#Linear Regression Model
from sklearn.linear_model import LinearRegression
```

In [9]:
```
X = df_dodger['day'].values.reshape(-1, 1)  # values converts it into a numpy array
Y = df_dodger['attend'].values.reshape(-1, 1)  # -1 means that calculate the dimension of rows, but have 1 column
linear_regressor = LinearRegression()  # create object for the class
linear_regressor.fit(X, Y)  # perform linear regression
Y_pred = linear_regressor.predict(X)  # make predictions
```

In [11]:
```
#Scatter Plot with prediction
plt.scatter(X, Y)
plt.plot(X, Y_pred, color='red')

#Labels
plt.title('Linear Regression Plot of Attendance count to Day')
plt.xlabel('Day')
plt.ylabel('Attendance Count')
plt.show()
```



In [16]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.
2, random_state=0)
```

In [17]:
```
regressor = LinearRegression()
regressor.fit(X_train, y_train)
```

Out[17]:
```
LinearRegression()
```

In [18]:
```
print(regressor.intercept_)
```

```
41004.52856828934
```

In [19]:
```
print(regressor.coef_)
```

```
[-8.92328074]
```

In [30]:
```
y_pred = regressor.predict(X_test)
```

In [31]:
```
from sklearn import metrics
print('Mean Absolute Error:', metrics.mean_absolute_error(y_test, y_pre
d))
print('Mean Squared Error:', metrics.mean_squared_error(y_test, y_pre
d))
print('Root Mean Squared Error:', np.sqrt(metrics.mean_squared_error(y_
test, y_pred)))
```

```
Mean Absolute Error: 5875.409299900461
Mean Squared Error: 52735122.72298296
Root Mean Squared Error: 7261.895256954823
```

In [32]:
```
df = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred})
df
```

Out[32]:

	Actual	Predicted
22	44005	40264.958098
27	51137	40667.155788
61	39805	41270.452323
13	32799	40667.155788
71	43309	41069.353478
74	35754	40264.958098
30	50559	40466.056943
55	32659	40466.056943
53	46588	41471.551168
26	38016	40466.056943
50	52832	40667.155788
42	53570	40868.254633
48	39955	40868.254633
33	40432	41270.452323
73	42449	41471.551168
2	28328	41069.353478
57	37084	40868.254633

In [13]:
```
#Make a copy for later
df_dodger_copy_1 = df_dodger.copy(deep=True)
```

In [14]:
```
#Get dummy variables for day of week
df_dodger_copy_1 = pd.get_dummies(df_dodger_copy_1, columns=['day_of_week'])
```

In [21]:
```
df_dodger_copy_1.head(23)
```

Out[21]:

	month	day	attend	opponent	temp	skies	day_night	cap	shirt	fireworks	bobblehead
0	APR	10	56000	Pirates	67	Clear	Day	NO	NO	NO	NO
1	APR	11	29729	Pirates	58	Cloudy	Night	NO	NO	NO	NO
2	APR	12	28328	Pirates	57	Cloudy	Night	NO	NO	NO	NO
3	APR	13	31601	Padres	54	Cloudy	Night	NO	NO	YES	NO
4	APR	14	46549	Padres	57	Cloudy	Night	NO	NO	NO	NO
5	APR	15	38359	Padres	65	Clear	Day	NO	NO	NO	NO
6	APR	23	26376	Braves	60	Cloudy	Night	NO	NO	NO	NO
7	APR	24	44014	Braves	63	Cloudy	Night	NO	NO	NO	NO
8	APR	25	26345	Braves	64	Cloudy	Night	NO	NO	NO	NO
9	APR	27	44807	Nationals	66	Clear	Night	NO	NO	YES	NO
10	APR	28	54242	Nationals	71	Clear	Night	NO	NO	NO	YES
11	APR	29	48753	Nationals	74	Clear	Day	NO	YES	NO	NO
12	MAY	7	43713	Giants	67	Clear	Night	NO	NO	NO	NO
13	MAY	8	32799	Giants	75	Clear	Night	NO	NO	NO	NO
14	MAY	9	33993	Giants	71	Clear	Night	NO	NO	NO	NO
15	MAY	11	35591	Rockies	65	Clear	Night	NO	NO	YES	NO
16	MAY	12	33735	Rockies	65	Clear	Night	NO	NO	NO	NO
17	MAY	13	49124	Rockies	70	Clear	Day	NO	NO	NO	NO
18	MAY	14	24312	Snakes	67	Clear	Night	NO	NO	NO	NO
19	MAY	15	47077	Snakes	70	Clear	Night	NO	NO	NO	YES
20	MAY	18	40906	Cardinals	64	Clear	Night	NO	NO	YES	NO
21	MAY	19	39383	Cardinals	67	Clear	Night	NO	NO	NO	NO
22	MAY	20	44005	Cardinals	77	Clear	Night	NO	NO	NO	NO

In [25]:
```
df_thursdays = df_dodger[df_dodger['day_of_week'] == 'Thursday']
```

In [26]:
```
df_thursdays.sort_values(by=['day_of_week'])
```

Out[26]:

	month	day	attend	day_of_week	opponent	temp	skies	day_night	cap	shirt	fireworl
2	APR	12	28328	Thursday	Pirates	57	Cloudy	Night	NO	NO	N
29	MAY	31	26773	Thursday	Brewers	70	Clear	Night	NO	NO	N
36	JUN	28	49006	Thursday	Mets	75	Clear	Night	NO	NO	N
64	AUG	30	54621	Thursday	Snakes	80	Clear	Night	NO	NO	N
71	SEP	13	43309	Thursday	Cardinals	80	Clear	Night	NO	NO	N

In [27]:
```
df_dodger['day_of_week'].value_counts()
```

Out[27]:
```
Friday       13
Tuesday      13
Sunday       13
Saturday     13
Wednesday    12
Monday       12
Thursday      5
Name: day_of_week, dtype: int64
```

In [29]:
```
df_mondays = df_dodger[df_dodger['day_of_week'] == 'Monday']
df_mondays.sort_values(by=['day_of_week'])
```

Out[29]:

	month	day	attend	day_of_week	opponent	temp	skies	day_night	cap	shirt	fireworl
6	APR	23	26376	Monday	Braves	60	Cloudy	Night	NO	NO	N
12	MAY	7	43713	Monday	Giants	67	Clear	Night	NO	NO	N
18	MAY	14	24312	Monday	Snakes	67	Clear	Night	NO	NO	N
26	MAY	28	38016	Monday	Brewers	73	Clear	Night	NO	NO	N
30	JUN	11	50559	Monday	Angels	68	Clear	Night	NO	YES	N
40	JUL	2	34493	Monday	Reds	70	Clear	Night	NO	NO	N
46	JUL	16	32238	Monday	Phillies	67	Clear	Night	NO	NO	N
49	JUL	30	33180	Monday	Snakes	73	Clear	Night	NO	NO	N
55	AUG	6	32659	Monday	Rockies	79	Clear	Night	NO	NO	N
58	AUG	20	36878	Monday	Giants	80	Clear	Night	NO	NO	N
68	SEP	3	33540	Monday	Padres	84	Cloudy	Night	NO	NO	N
78	OCT	1	33624	Monday	Giants	86	Clear	Night	NO	NO	N

In [ ]:
```
```