Week 3

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- Bellevue University
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- 09/18/2022

In [ ]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
```

Recommendations:

- It would seem that games played during the summer months along with clear skys are when attendance is the greatest. Recommend that games scheduled in spring and fall, or historically cloudy days should be scheduled less.

- Games on Tuesdays and Saturdays are often trending towards positive attendance. Mondays and Wednesdays trend negatively for attendance. If management added more games to the roster on Tuesdays and Saturdays while lowering the game roster of Mondays and Wednesdays could increase attendance

- Games where the dodgers played:

    - Angeles
    - Cubs
    - Mets
    - Nationals
    - White Sox
- Saw larger turnout and increased attendance

- Games where the dodgers played:

    - Astros
    - Braves
    - Bruins
    - Pirates
    - Rockies
    - Snakes

- Saw less turnout and a decreased attendance
- Games where there were promotions such as Bobbleheads and shirts had the higher attendance rates. Management should offer more promotions as it would seem that have a positive impact on increasing attendance for the season

In [ ]:
```
df = pd.read_csv('./Week3/dodgers-2022.csv', delimiter=',')
df.head(10)
```

Out[ ]:

	month	day	attend	day_of_week	opponent	temp	skies	day_night	cap	shirt	fireworks	bo
0	APR	10	56000	Tuesday	Pirates	67	Clear	Day	NO	NO	NO	
1	APR	11	29729	Wednesday	Pirates	58	Cloudy	Night	NO	NO	NO	
2	APR	12	28328	Thursday	Pirates	57	Cloudy	Night	NO	NO	NO	
3	APR	13	31601	Friday	Padres	54	Cloudy	Night	NO	NO	YES	
4	APR	14	46549	Saturday	Padres	57	Cloudy	Night	NO	NO	NO	
5	APR	15	38359	Sunday	Padres	65	Clear	Day	NO	NO	NO	
6	APR	23	26376	Monday	Braves	60	Cloudy	Night	NO	NO	NO	
7	APR	24	44014	Tuesday	Braves	63	Cloudy	Night	NO	NO	NO	
8	APR	25	26345	Wednesday	Braves	64	Cloudy	Night	NO	NO	NO	
9	APR	27	44807	Friday	Nationals	66	Clear	Night	NO	NO	YES	

In [ ]:
```
df.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     object
 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(3), object(9)
memory usage: 7.7+ KB
```

In [ ]:
```
print(f'Home games played: {df.shape[0]}')
```

```
Home games played: 81
```

In [ ]:
```
#any nulls or missing
df.isnull().any()
```

Out[ ]:
```
month          False
day            False
attend         False
day_of_week    False
opponent       False
temp           False
skies          False
day_night      False
cap            False
shirt          False
fireworks      False
bobblehead     False
dtype: bool
```

In [ ]:
```
dates_targets = df[['month','day','day_of_week','day_night']]
dates_targets.head(20)
```

Out[ ]:

	month	day	day_of_week	day_night
0	APR	10	Tuesday	Day
1	APR	11	Wednesday	Night
2	APR	12	Thursday	Night
3	APR	13	Friday	Night
4	APR	14	Saturday	Night
5	APR	15	Sunday	Day
6	APR	23	Monday	Night
7	APR	24	Tuesday	Night
8	APR	25	Wednesday	Night
9	APR	27	Friday	Night
10	APR	28	Saturday	Night
11	APR	29	Sunday	Day
12	MAY	7	Monday	Night
13	MAY	8	Tuesday	Night
14	MAY	9	Wednesday	Night
15	MAY	11	Friday	Night
16	MAY	12	Saturday	Night
17	MAY	13	Sunday	Day
18	MAY	14	Monday	Night
19	MAY	15	Tuesday	Night

In [ ]:
```
desc = dates_targets.describe()
desc
```

Out[ ]:

	day
count	81.000000
mean	16.135802
std	9.605666
min	1.000000
25%	8.000000
50%	15.000000
75%	25.000000
max	31.000000

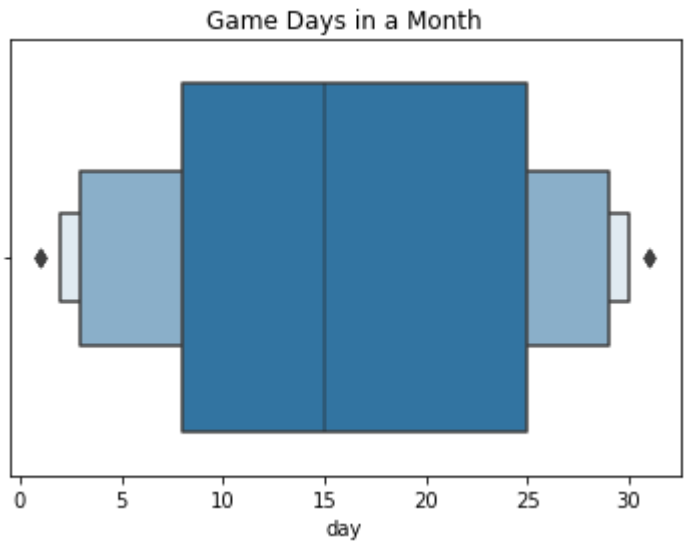
In [ ]:
```
dates_targets['day_night'].value_counts()
```

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

In [ ]:
```
sns.boxenplot(dates_targets['day'])
plt.title("Game Days in a Month")
```

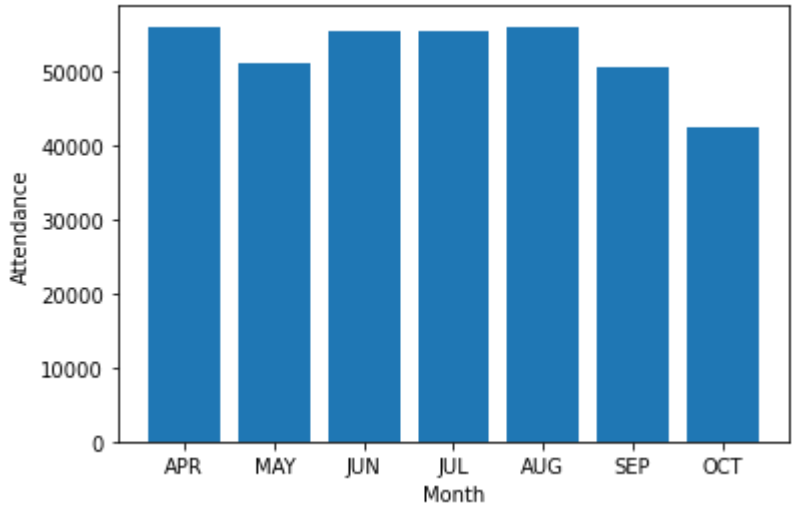
```
c:\Users\Joshu\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning:
Pass the following variable as a keyword arg: x. From version 0.12, the only valid po
sitional argument will be `data`, and passing other arguments without an explicit key
word will result in an error or misinterpretation.
  warnings.warn(
```

Out[ ]:
```
Text(0.5, 1.0, 'Game Days in a Month')
```



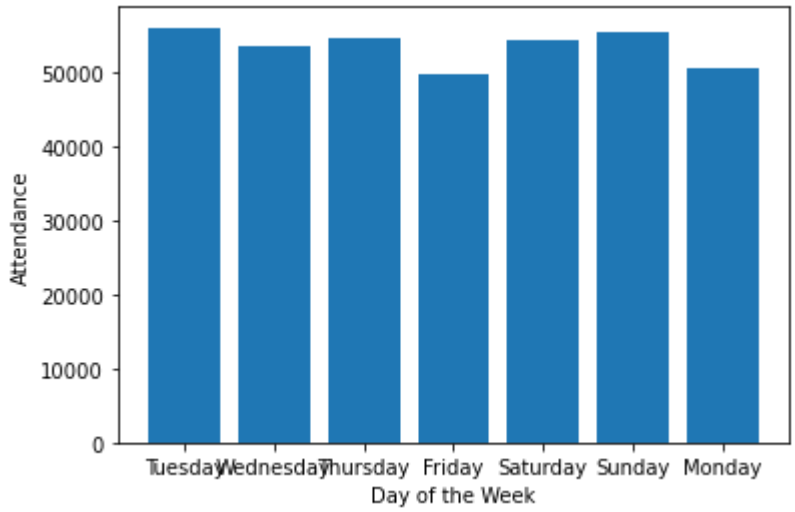
In [ ]:
```
#Checking attendance
plt.bar(df['month'],df['attend'])
plt.xlabel('Month')
plt.ylabel('Attendance')
```

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



In [ ]:
```
#bar graph visualization for attendance counts for day of the week
plt.bar(df['day_of_week'],df['attend'])
plt.xlabel('Day of the Week')
plt.ylabel('Attendance')
```

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



In [ ]:
```
df.attend.mean()
```

Out[ ]:
```
41040.07407407407
```

In [ ]:
```
df.attend.max()
```

Out[ ]:
```
56000
```

In [ ]:
```
df.query('attend == 56000')
```

Out[ ]:

	month	day	attend	day_of_week	opponent	temp	skies	day_night	cap	shirt	fireworks	bol
0	APR	10	56000	Tuesday	Pirates	67	Clear	Day	NO	NO	NO	
59	AUG	21	56000	Tuesday	Giants	75	Clear	Night	NO	NO	NO	

In [ ]:

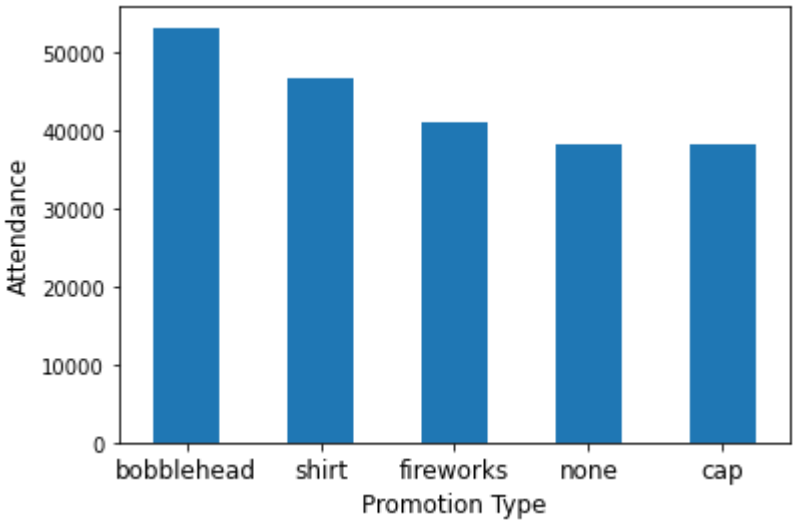
```
```

In [ ]:

```
lad = df.groupby(['cap', 'shirt', 'fireworks', 'bobblehead']).attend.mean().sort_value
lad.set_xticklabels(['bobblehead', 'shirt', 'fireworks', 'none', 'cap'], rotation=0, f
lad.set_xlabel("Promotion Type", fontsize=12)
lad.set_ylabel("Attendance", fontsize=12)
```

Out[ ]:

```
Text(0, 0.5, 'Attendance')
```



In [ ]:

```
df.bobblehead.value_counts()
```

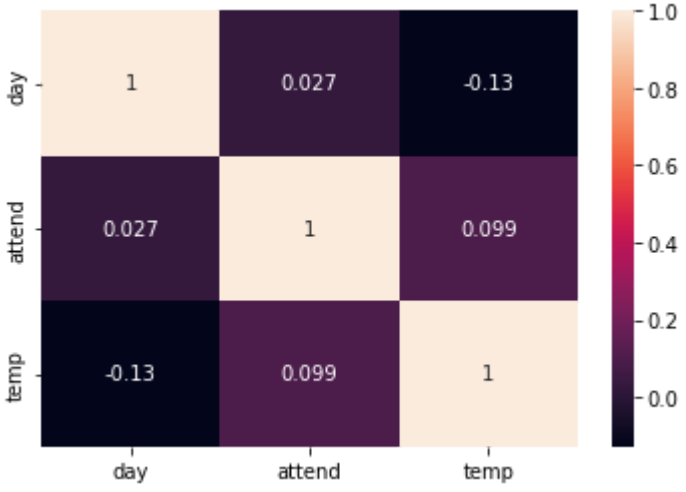
Out[ ]:

```
NO     70
YES    11
Name: bobblehead, dtype: int64
```

In [ ]:

```
correlation_mat = df.corr()

sns.heatmap(correlation_mat, annot = True)
plt.show()
```



In [ ]:

```
df1 = pd.concat([df.drop(['month', 'day_of_week', 'opponent','skies','day_night', 'cap
df1.head(5)
```

Out[ ]:

	day	attend	temp	month_APR	month_AUG	month_JUL	month_JUN	month_MAY	month_OCT
0	10	56000	67	1	0	0	0	0	0
1	11	29729	58	1	0	0	0	0	0
2	12	28328	57	1	0	0	0	0	0
3	13	31601	54	1	0	0	0	0	0
4	14	46549	57	1	0	0	0	0	0

5 rows × 44 columns

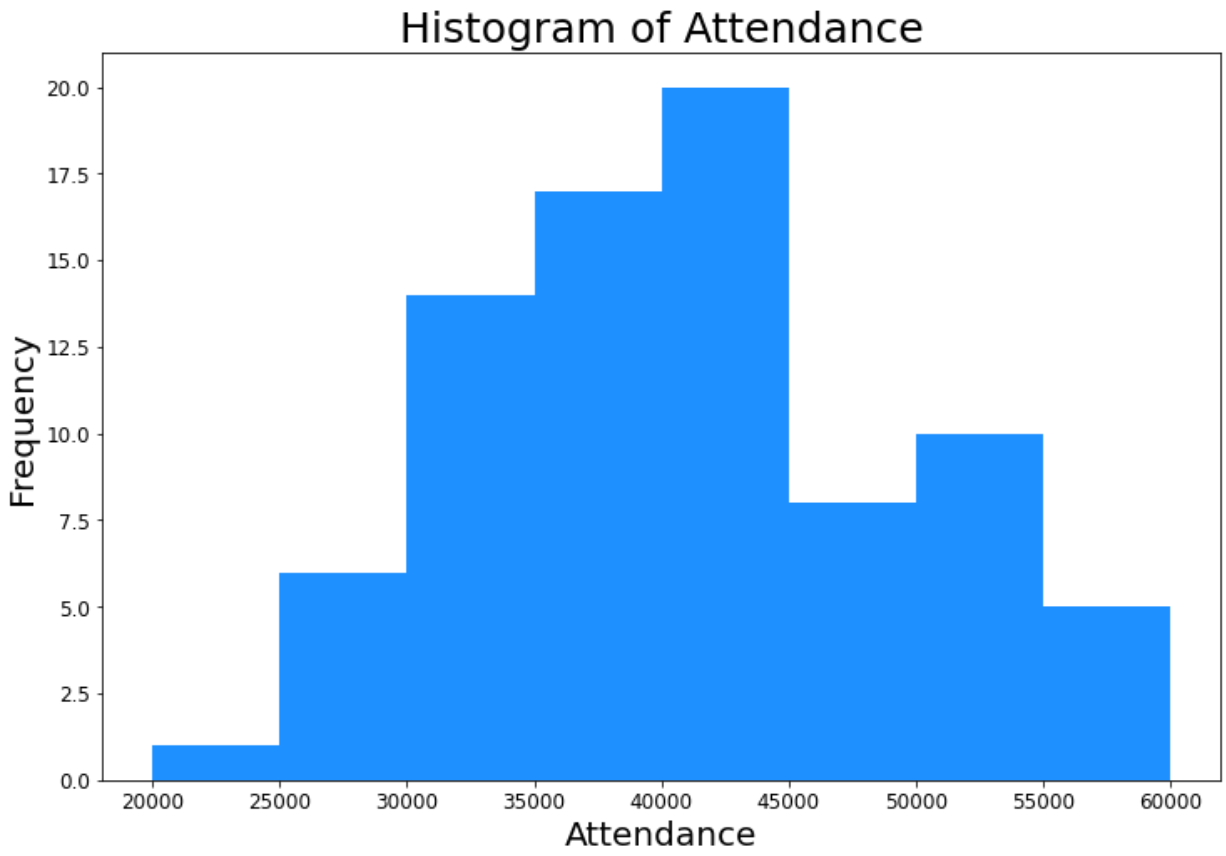
In [ ]:
```
df1.corr('spearman').style.background_gradient(cmap="Greens")
```

Out[ ]:

	day	attend	temp	month_APR	month_AUG	month_JUL	mont
day	1.000000	0.063626	-0.123692	0.104875	-0.028569	-0.079586	0.
attend	0.063626	1.000000	0.090628	-0.055739	0.101270	0.096614	0.
temp	-0.123692	0.090628	1.000000	-0.495820	0.296848	0.012656	-0.
month_APR	0.104875	-0.055739	-0.495820	1.000000	-0.198811	-0.173913	-0.
month_AUG	-0.028569	0.101270	0.296848	-0.198811	1.000000	-0.198811	-0.
month_JUL	-0.079586	0.096614	0.012656	-0.173913	-0.198811	1.000000	-0.
month_JUN	0.108461	0.314192	-0.132964	-0.147442	-0.168550	-0.147442	1.
month_MAY	0.153172	-0.223536	-0.337159	-0.222911	-0.254824	-0.222911	-0.
month_OCT	-0.293820	-0.109043	0.268880	-0.081786	-0.093495	-0.081786	-0.
month_SEP	-0.113057	-0.109991	0.527833	-0.173913	-0.198811	-0.173913	-0.
day_of_week_Friday	0.134612	-0.030209	-0.167878	0.007013	0.051309	-0.087664	0.
day_of_week_Monday	-0.119007	-0.325514	-0.024568	-0.076087	-0.019881	0.119565	-0.
day_of_week_Saturday	0.083503	0.128028	-0.044672	0.007013	-0.035275	-0.087664	0.
day_of_week_Sunday	0.035273	0.051787	0.237768	0.007013	-0.035275	0.007013	-0.
day_of_week_Thursday	0.172376	-0.008776	0.014286	0.037438	0.009782	-0.106966	0.
day_of_week_Tuesday	-0.090701	0.333736	-0.020895	0.007013	-0.035275	0.101690	-0.
day_of_week_Wednesday	-0.165867	-0.167959	0.010423	0.021739	0.069584	0.021739	-0.
opponent_Angels	-0.106335	0.204106	-0.184855	-0.081786	-0.093495	-0.081786	0.
opponent_Astros	0.179090	-0.156575	-0.226868	-0.081786	-0.093495	-0.081786	-0.
opponent_Braves	0.141313	-0.167758	-0.278683	0.470270	-0.093495	-0.081786	-0.
opponent_Brewers	0.319518	-0.134038	-0.059812	-0.095050	-0.108657	-0.095050	-0.
opponent_Cardinals	0.038556	0.015034	0.181659	-0.128262	-0.146625	-0.128262	-0.
opponent_Cubs	-0.237854	0.109043	0.082625	-0.081786	0.411377	-0.081786	-0.
opponent_Giants	-0.216080	-0.086529	0.196922	-0.147442	0.134840	-0.147442	-0.
opponent_Marlins	0.159502	0.002796	0.032210	-0.081786	0.411377	-0.081786	-0.
opponent_Mets	0.130490	0.248580	0.076901	-0.095050	-0.108657	0.065347	0.
opponent_Nationals	0.225262	0.204106	-0.079824	0.470270	-0.093495	-0.081786	-0.
opponent_Padres	-0.188335	0.038644	-0.010099	0.184302	-0.168550	0.184302	-0.
opponent_Phillies	0.053167	-0.011184	-0.025208	-0.081786	-0.093495	0.470270	-0.
opponent_Pirates	-0.131519	-0.082481	-0.273081	0.470270	-0.093495	-0.081786	-0.
opponent_Reds	-0.264438	-0.030756	-0.092428	-0.081786	-0.093495	0.470270	-0.
opponent_Rockies	-0.021860	-0.082328	0.161577	-0.147442	0.134840	-0.147442	-0.
opponent_Snakes	0.052969	-0.089049	0.167468	-0.147442	0.134840	0.073721	-0.

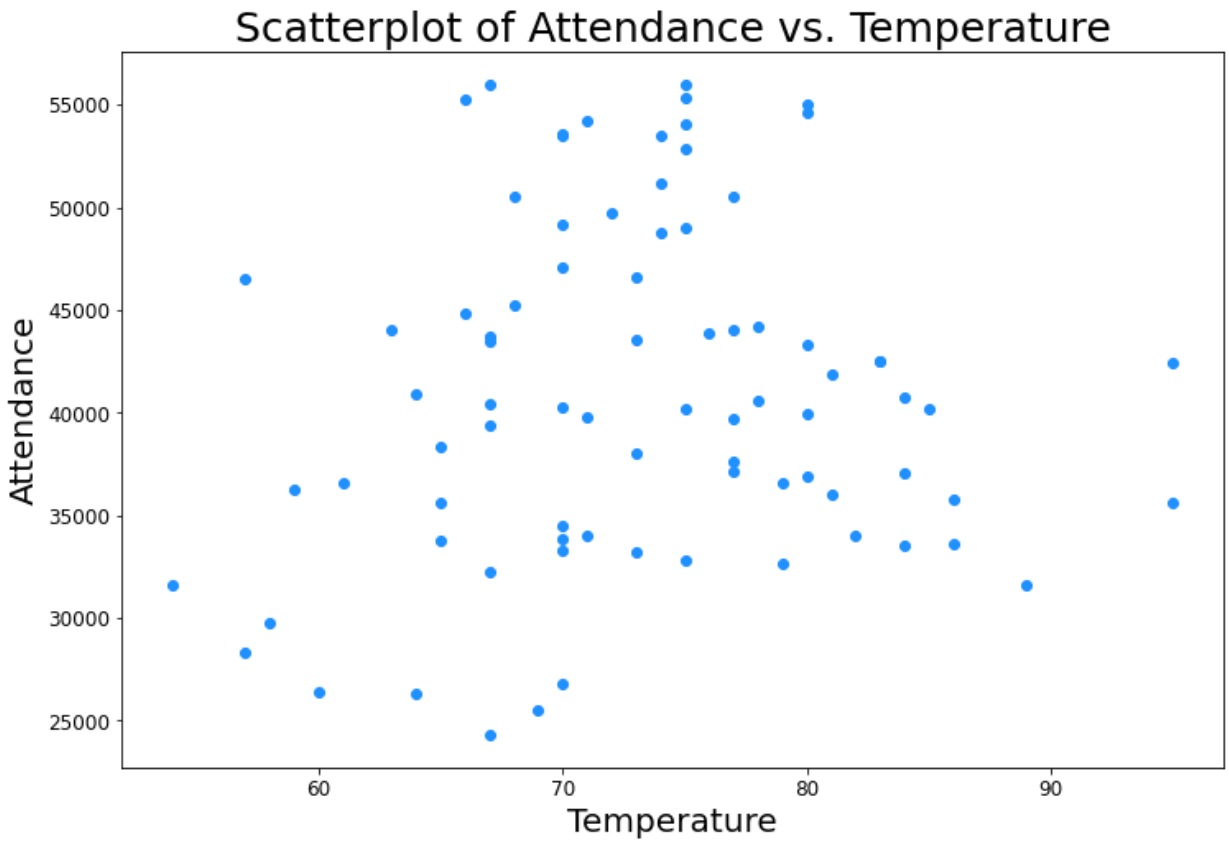
	day	attend	temp	month_APR	month_AUG	month_JUL	mont
opponent_White Sox	0.029382	0.139799	-0.102230	-0.081786	-0.093495	-0.081786	0.
skies_Clear	0.054252	0.144553	0.259024	-0.343251	0.188903	-0.097204	0.
skies_Cloudy	-0.054252	-0.144553	-0.259024	0.343251	-0.188903	0.097204	-0.
day_night_Day	0.052377	0.031944	0.249189	0.069584	0.018182	-0.019881	0.
day_night_Night	-0.052377	-0.031944	-0.249189	-0.069584	-0.018182	0.019881	-0.
cap_NO	0.194109	0.051039	-0.066466	0.066354	-0.128951	-0.157591	0.
cap_YES	-0.194109	-0.051039	0.066466	-0.066354	0.128951	0.157591	-0.
shirt_NO	0.037777	-0.139799	-0.011203	-0.102233	0.093495	0.081786	-0.
shirt_YES	-0.037777	0.139799	0.011203	0.102233	-0.093495	-0.081786	0.
fireworks_NO	-0.091546	-0.015361	0.178363	0.006808	-0.034245	0.006808	-0.
fireworks_YES	0.091546	0.015361	-0.178363	-0.006808	0.034245	-0.006808	0.

In [ ]:
```
plt.rcParams['figure.figsize'] = [12, 8]
bins = [20000, 25000, 30000, 35000, 40000, 45000, 50000, 55000, 60000]
plt.hist(df.attend, bins=bins, color='dodgerblue')
plt.xticks(bins, fontsize=12)
plt.yticks(fontsize=12)
plt.title("Histogram of Attendance", fontsize=25)
plt.xlabel("Attendance", fontsize=20)
plt.ylabel("Frequency", fontsize=20)
plt.show()
```



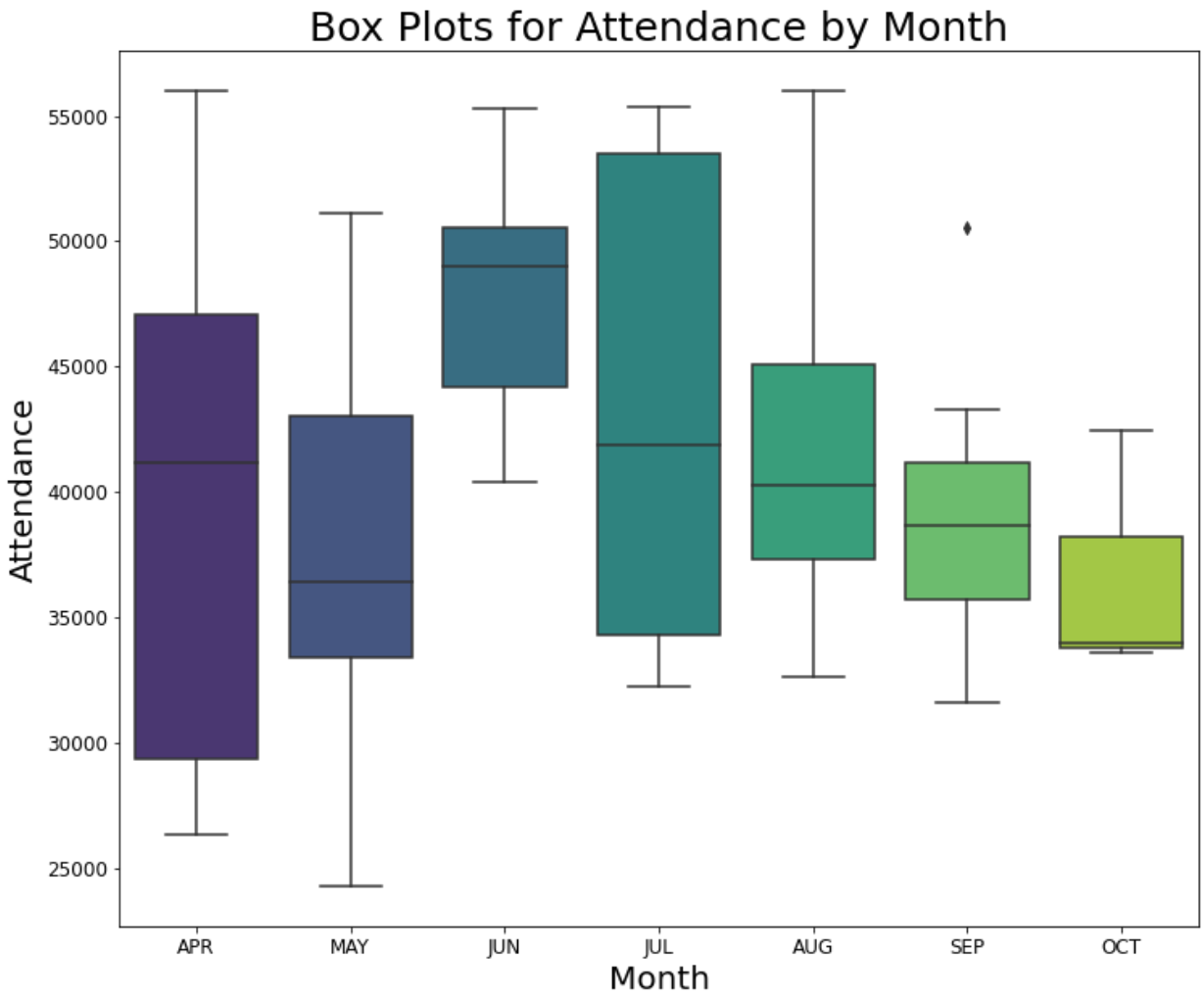
In [ ]:
```
plt.rcParams['figure.figsize'] = [12, 8]
plt.scatter(df.temp, df.attend, color='dodgerblue')
plt.xticks(fontsize=12)
plt.yticks(fontsize=12)
plt.title("Scatterplot of Attendance vs. Temperature", fontsize=25)
plt.xlabel("Temperature", fontsize=20)
plt.ylabel("Attendance", fontsize=20)
```

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



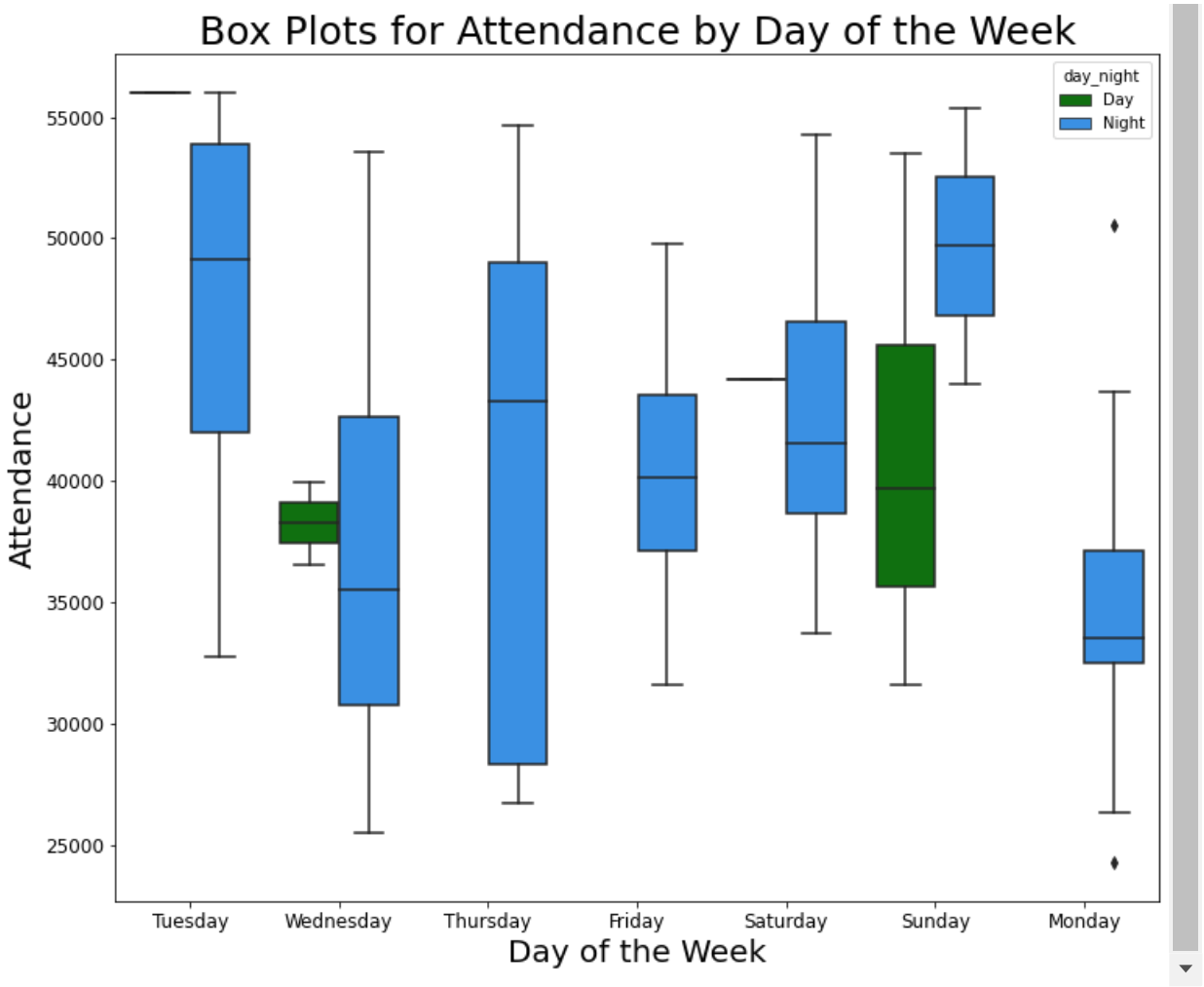
In [ ]:
```
plt.rcParams['figure.figsize'] = [12, 10]
sns.boxplot(df.month, df.attend, palette="viridis")
plt.xticks(fontsize=12)
plt.yticks(fontsize=12)
plt.title("Box Plots for Attendance by Month", fontsize=25)
plt.xlabel("Month", fontsize=20)
plt.ylabel("Attendance", fontsize=20)
plt.show()
```

```
c:\Users\Joshu\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning:
Pass the following variables as keyword args: x, y. From version 0.12, the only valid
positional argument will be `data`, and passing other arguments without an explicit k
eyword will result in an error or misinterpretation.
  warnings.warn(
```



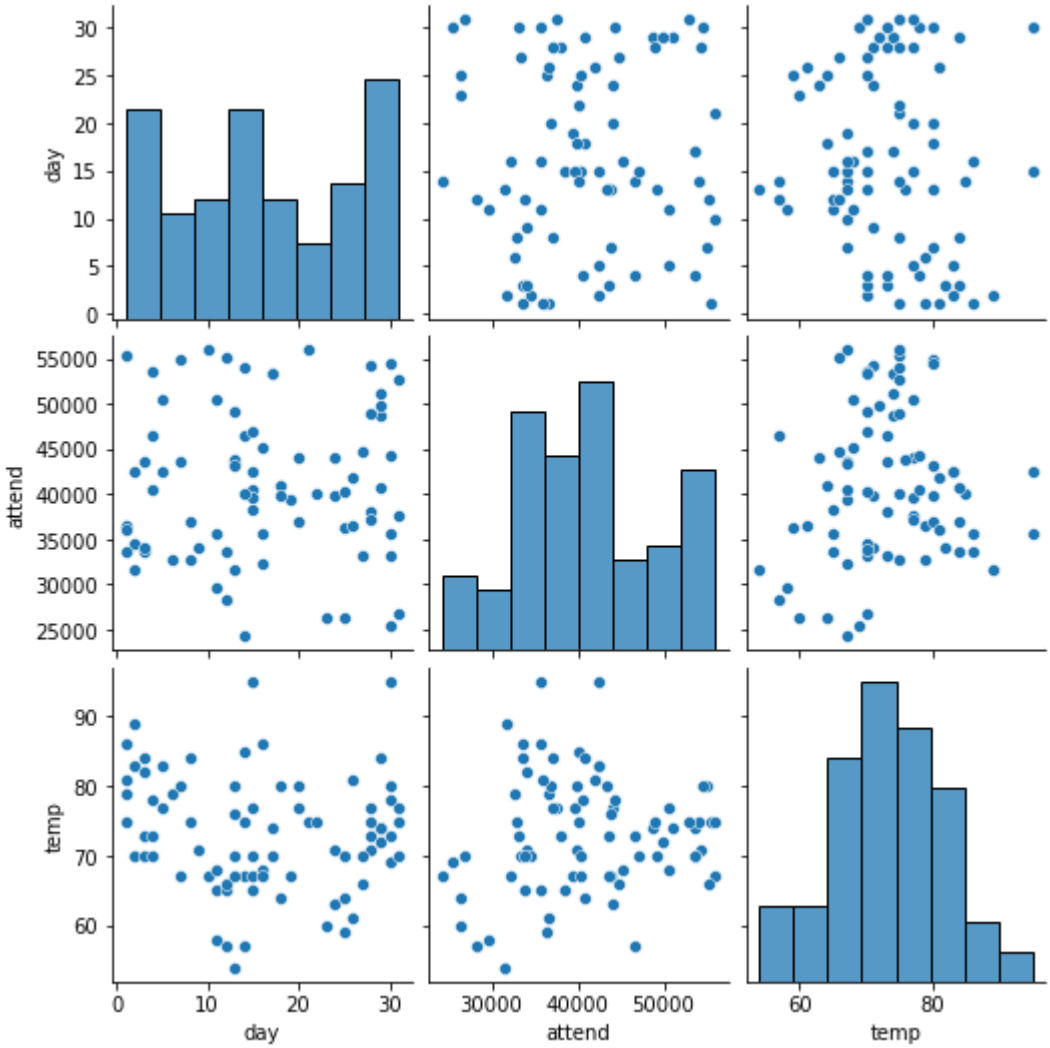
In [ ]:
```
plt.rcParams['figure.figsize'] = [12, 10]
colors = ('green', 'dodgerblue')
sns.boxplot(df.day_of_week, df.attend, hue = df.day_night, palette=colors)
plt.xticks(fontsize=12)
plt.yticks(fontsize=12)
plt.title("Box Plots for Attendance by Day of the Week", fontsize=25)
plt.xlabel("Day of the Week", fontsize=20)
plt.ylabel("Attendance", fontsize=20)
plt.show()
```

```
c:\Users\Joshu\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarnin
g: Pass the following variables as keyword args: x, y. From version 0.12, the only
valid positional argument will be `data`, and passing other arguments without an ex
plicit keyword will result in an error or misinterpretation.
  warnings.warn(
```



In [ ]:
```
sns.pairplot(df)
```

Out[ ]:
```
<seaborn.axisgrid.PairGrid at 0x2ebab2e6cd0>
```



In [ ]:
```
df.groupby('month').attend.describe().sort_values('mean')
```

Out[ ]:

month	count	mean	std	min	25%	50%	75%	max
OCT	3.0	36703.666667	5000.193030	33624.0	33819.00	34014.0	38243.50	42473.0
MAY	18.0	37345.722222	7721.822307	24312.0	33413.25	36422.0	43011.25	51137.0
SEP	12.0	38955.083333	5135.247758	31607.0	35717.25	38650.0	41155.25	50560.0
APR	12.0	39591.916667	10882.001583	26345.0	29378.75	41186.5	47100.00	56000.0
AUG	15.0	42751.533333	7256.695921	32659.0	37353.00	40284.0	45062.50	56000.0
JUL	12.0	43884.250000	9399.324716	32238.0	34340.75	41914.0	53516.00	55359.0
JUN	9.0	47940.444444	4919.203063	40432.0	44217.00	49006.0	50559.00	55279.0

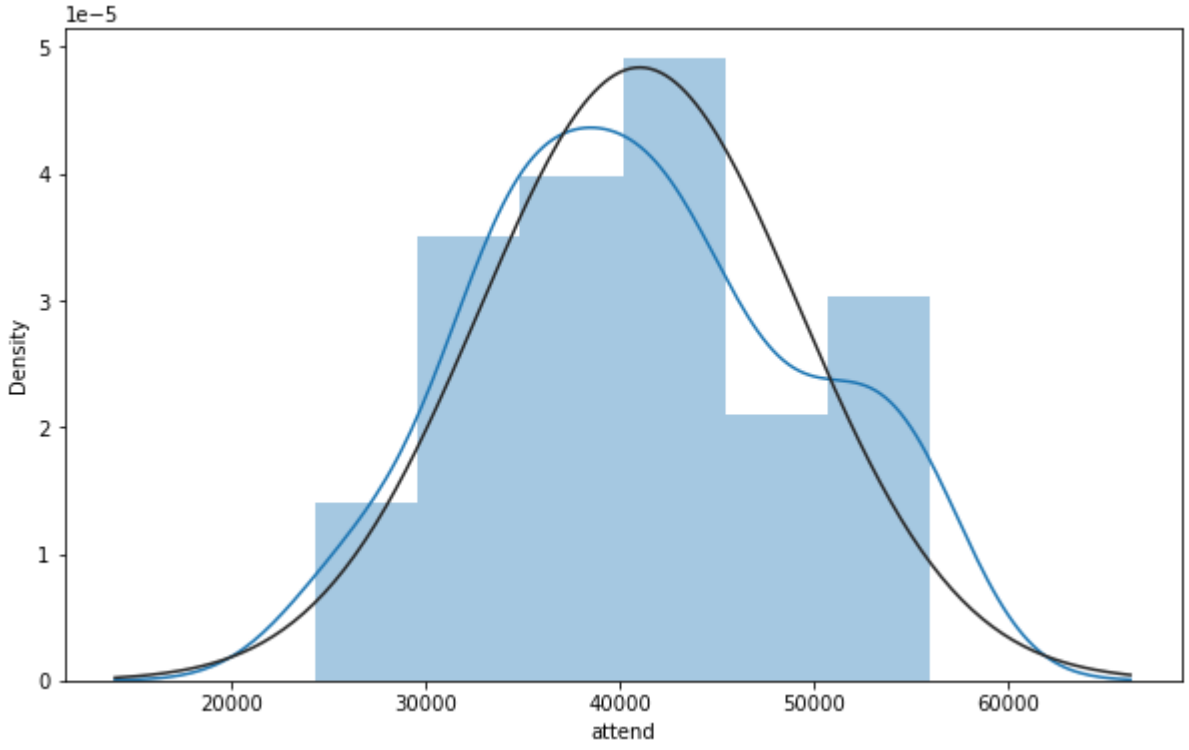
In [ ]:
```
df.groupby('day_of_week').attend.describe().sort_values('mean')
```

Out[ ]:

day_of_week	count	mean	std	min	25%	50%	75%	max
Monday	12.0	34965.666667	7005.957949	24312.0	32553.75	33582.0	37162.50	50559.0
Wednesday	12.0	37585.166667	8696.234889	25509.0	32927.00	36840.0	41003.25	53570.0
Friday	13.0	40116.923077	4694.879400	31601.0	37133.00	40167.0	43537.00	49763.0
Thursday	5.0	40407.400000	12411.591328	26773.0	28328.00	43309.0	49006.00	54621.0
Sunday	13.0	42268.846154	7596.350657	31607.0	35754.00	41907.0	48753.00	55359.0
Saturday	13.0	43072.923077	6336.482298	33735.0	39383.00	42449.0	46549.00	54242.0
Tuesday	13.0	47741.230769	8291.390044	32799.0	42473.00	51137.0	55024.00	56000.0

In [ ]:
```
from scipy.stats import norm
plt.figure(figsize=(10,6))
sns.distplot(df['attend'], fit=norm);
fig = plt.figure()
```

```
c:\Users\Joshu\anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarni
ng: `distplot` is a deprecated function and will be removed in a future version. Plea
se adapt your code to use either `displot` (a figure-level function with similar flex
ibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```




```
<Figure size 864x720 with 0 Axes>
```

In [ ]: