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Using Data to Improve MLB Attendace

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error, r2_score
import statsmodels.api as sm
from sklearn.preprocessing import LabelEncoder
```

In [2]:

```
path = r"C:\Users\chris\Documents\Bellevue University\7 - Predictive Analytics\dodgers-2022.csv"
mlb_attendance = pd.read_csv(path)
mlb_attendance.head()
```

Out[2]:

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

Coverting column values into numbers

In [3]:
```
# Convert columns, values to numbers
# Define the mappings for the specified columns
mappings = {
    'NO': 0,
    'YES': 1,
    'Day': 0,
    'Night': 1,
    'Clear ': 0,
    'Cloudy': 1,
    'Monday': 1,
    'Tuesday': 2,
    'Wednesday': 3,
    'Thursday': 4,
    'Friday': 5,
    'Saturday': 6,
    'Sunday': 7
}

# Apply the mappings to the specified columns
columns_to_map = ['bobblehead', 'cap', 'shirt', 'fireworks', 'day_night', 'skies', 'day_of_week']
mlb_df = mlb_attendance.copy()  # Create a copy of the original DataFrame

for column in columns_to_map:
    mlb_df[column] = mlb_df[column].replace(mappings)

mlb_df.head(20)
```

Out[3]:

	month	day	attend	day_of_week	opponent	temp	skies	day_night	cap	shirt	fireworks	bobblehead
0	APR	10	56000	2	Pirates	67	0	0	0	0	0	0
1	APR	11	29729	3	Pirates	58	1	1	0	0	0	0
2	APR	12	28328	4	Pirates	57	1	1	0	0	0	0
3	APR	13	31601	5	Padres	54	1	1	0	0	1	0
4	APR	14	46549	6	Padres	57	1	1	0	0	0	0
5	APR	15	38359	7	Padres	65	0	0	0	0	0	0
6	APR	23	26376	1	Braves	60	1	1	0	0	0	0
7	APR	24	44014	2	Braves	63	1	1	0	0	0	0
8	APR	25	26345	3	Braves	64	1	1	0	0	0	0
9	APR	27	44807	5	Nationals	66	0	1	0	0	1	0
10	APR	28	54242	6	Nationals	71	0	1	0	0	0	1
11	APR	29	48753	7	Nationals	74	0	0	0	1	0	0
12	MAY	7	43713	1	Giants	67	0	1	0	0	0	0
13	MAY	8	32799	2	Giants	75	0	1	0	0	0	0
14	MAY	9	33993	3	Giants	71	0	1	0	0	0	0
15	MAY	11	35591	5	Rockies	65	0	1	0	0	1	0
16	MAY	12	33735	6	Rockies	65	0	1	0	0	0	0
17	MAY	13	49124	7	Rockies	70	0	0	0	0	0	0
18	MAY	14	24312	1	Snakes	67	0	1	0	0	0	0
19	MAY	15	47077	2	Snakes	70	0	1	0	0	0	1

Finding the mean of attendance

In [4]:
```
mean_attendance = mlb_df['attend'].mean()

print(f"The mean attendance is: {mean_attendance}")
```

```
The mean attendance is: 41040.07407407407
```

Finding unique values in the columns

In [5]:
```
# List of columns to find unique values
columns_of_interest = ["day_of_week", "opponent", "skies", "day_night", "cap", "shirt", "fireworks", "bob

# Finds unique values in each specified column
unique_values = {col: mlb_df[col].unique() for col in columns_of_interest}

# Prints the unique values for each column
for col, values in unique_values.items():
    print(f"Unique values in column '{col}': {values}")
```

```
Unique values in column 'day_of_week': [2 3 4 5 6 7 1]
Unique values in column 'opponent': ['Pirates' 'Padres' 'Braves' 'Nationals' 'Giants' 'Rockies' 'Snake
s'
 'Cardinals' 'Astros' 'Brewers' 'Angels' 'White Sox' 'Mets' 'Reds'
 'Phillies' 'Cubs' 'Marlins']
Unique values in column 'skies': [0 1]
Unique values in column 'day_night': [0 1]
Unique values in column 'cap': [0 1]
Unique values in column 'shirt': [0 1]
Unique values in column 'fireworks': [0 1]
Unique values in column 'bobblehead': [0 1]
```

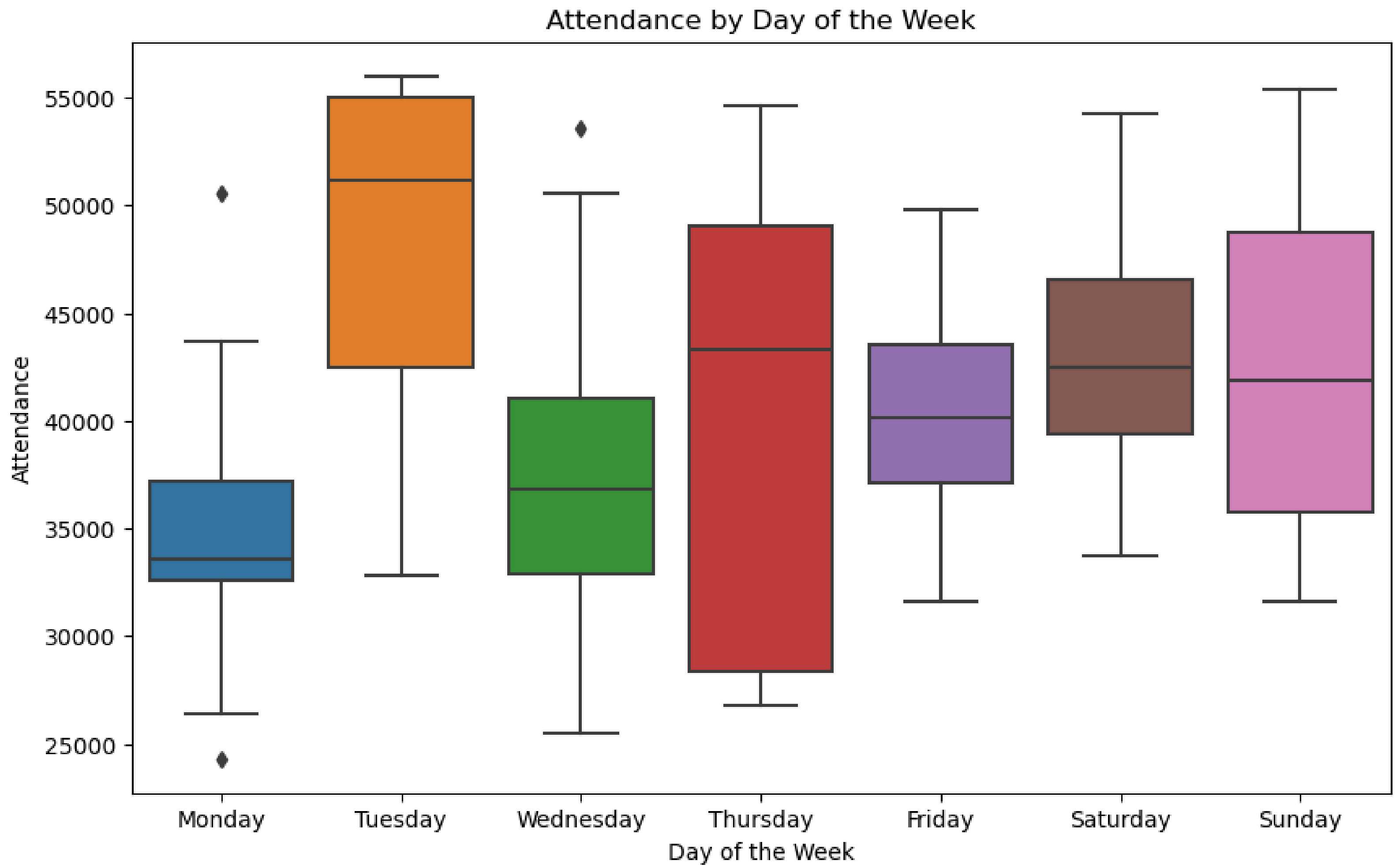
In [6]:
```
print(mlb_df.dtypes)
```

```
month          object
day             int64
attend          int64
day_of_week     int64
opponent       object
temp            int64
skies           int64
day_night       int64
cap             int64
shirt           int64
fireworks       int64
bobblehead      int64
dtype: object
```

Analyzing attendance by day of the week

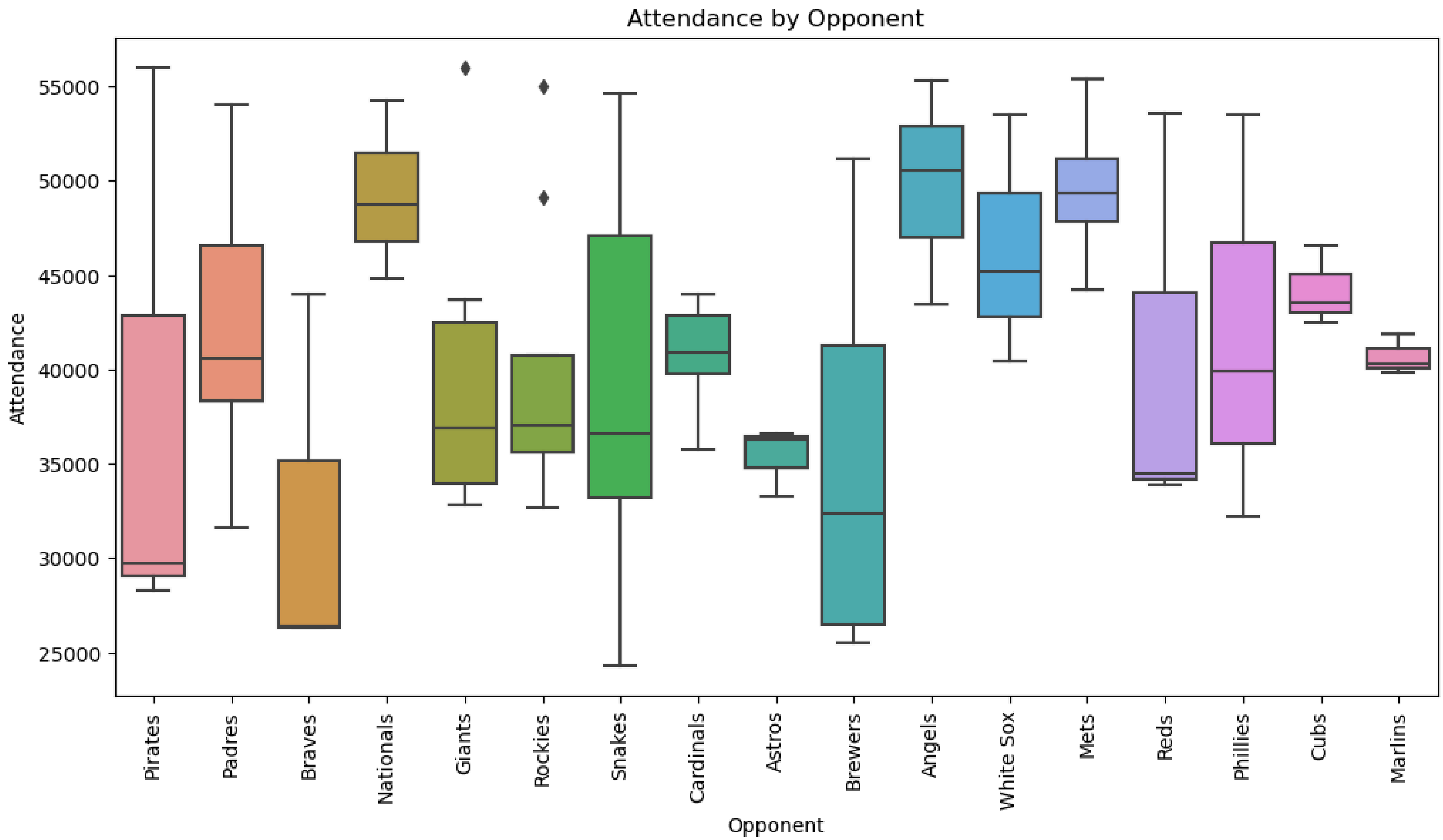
In [7]:

```
# Maps day_of_week to actual days for better readability
day_map = {1: 'Monday', 2: 'Tuesday', 3: 'Wednesday', 4: 'Thursday', 5: 'Friday', 6: 'Saturday', 7: 'Sunc
mlb_df['day_name'] = mlb_df['day_of_week'].map(day_map)

# Plots attendance by day of the week
plt.figure(figsize=(10, 6))
sns.boxplot(x='day_name', y='attend', data=mlb_df, order=['Monday', 'Tuesday', 'Wednesday', 'Thursday', '
plt.title('Attendance by Day of the Week')
plt.xlabel('Day of the Week')
plt.ylabel('Attendance')
plt.show()
```



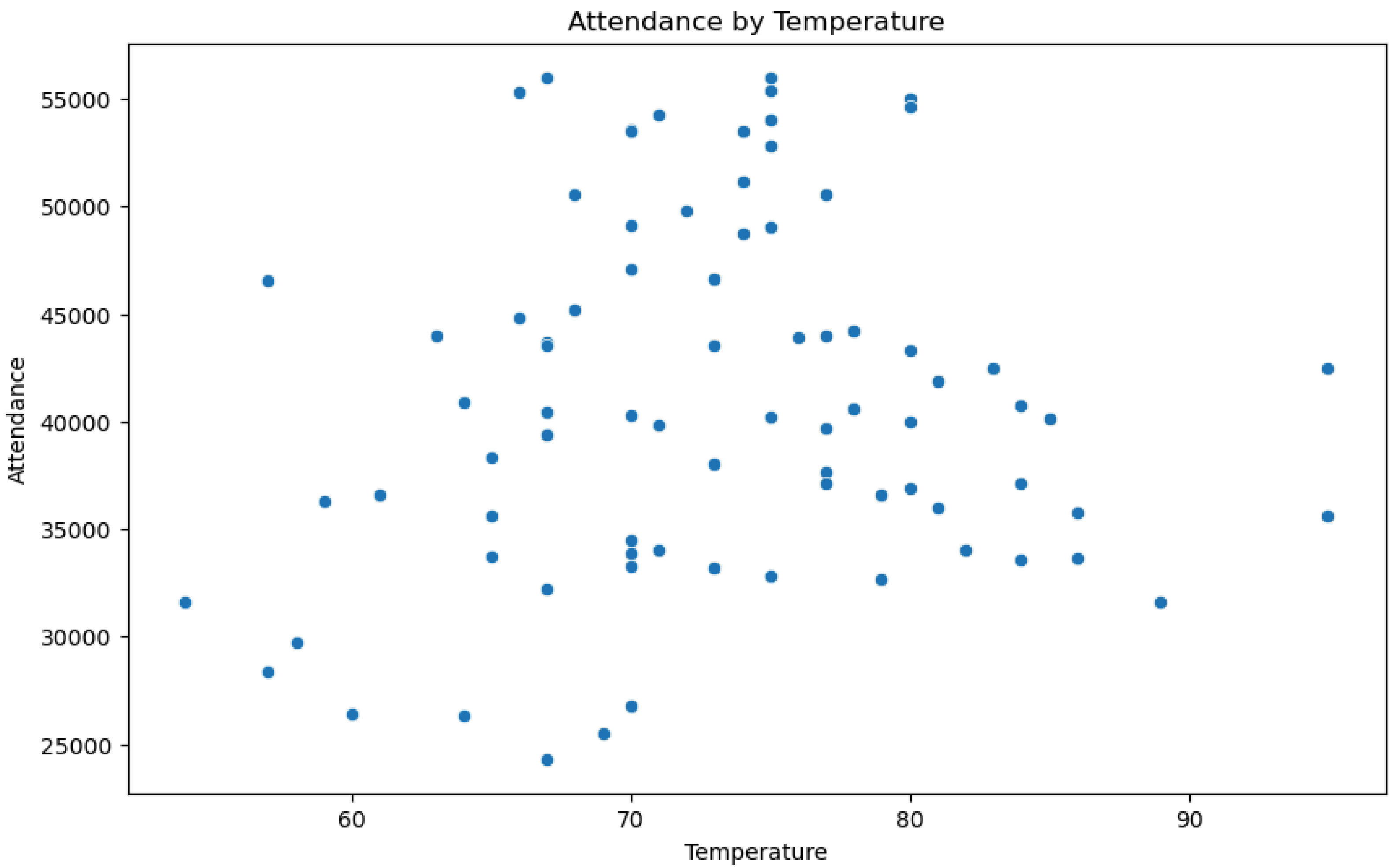
Analyzing attendance by Opponent

In [8]:
```
# Plots attendance by opponent
plt.figure(figsize=(12, 6))
sns.boxplot(x='opponent', y='attend', data=mlb_df)
plt.title('Attendance by Opponent')
plt.xlabel('Opponent')
plt.ylabel('Attendance')
plt.xticks(rotation=90)
plt.show()
```



Analyzing Attendance by Temperature

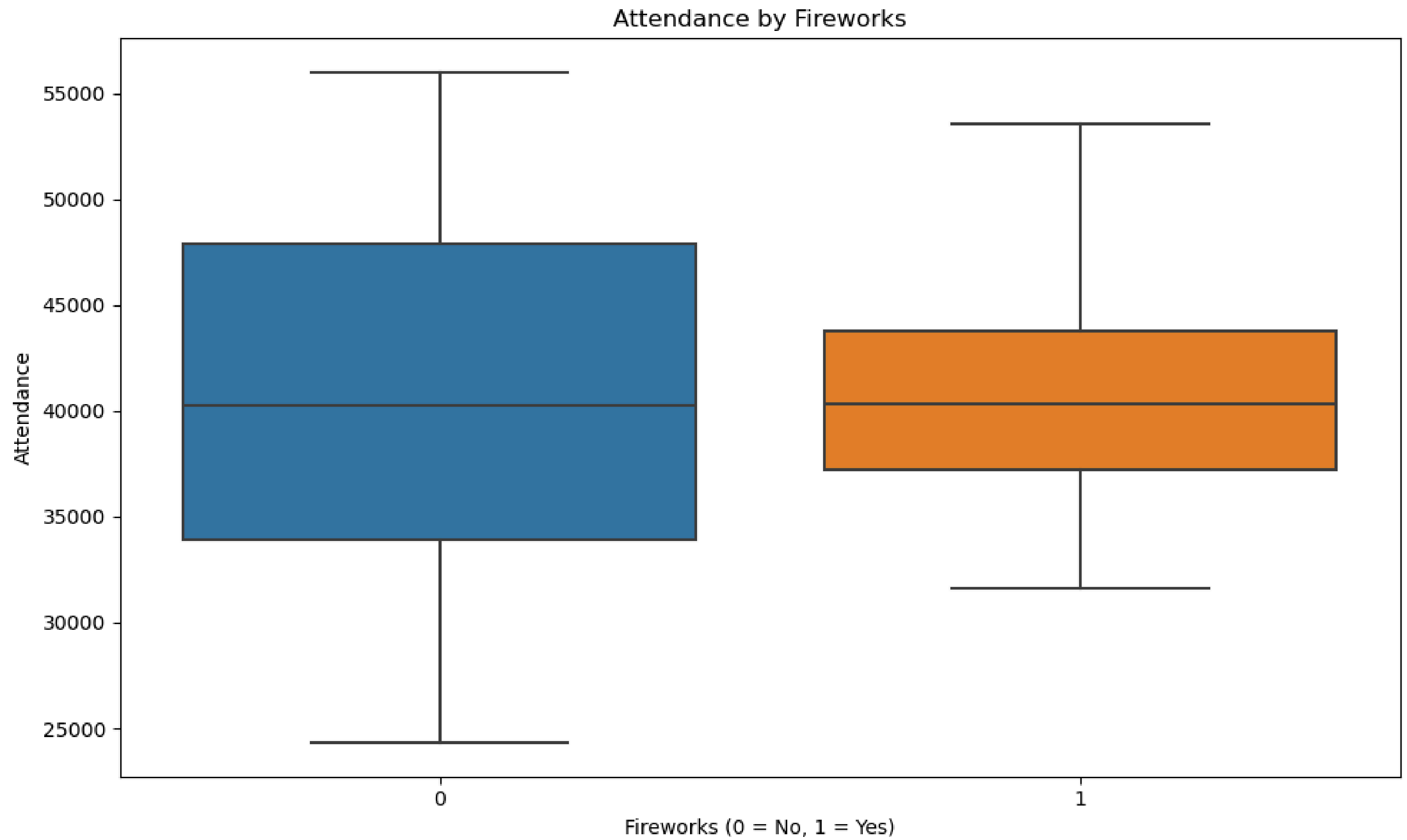
In [9]:
```
# Plots attendance by temperature
plt.figure(figsize=(10, 6))
sns.scatterplot(x='temp', y='attend', data=mlb_df)
plt.title('Attendance by Temperature')
plt.xlabel('Temperature')
plt.ylabel('Attendance')
plt.show()
```

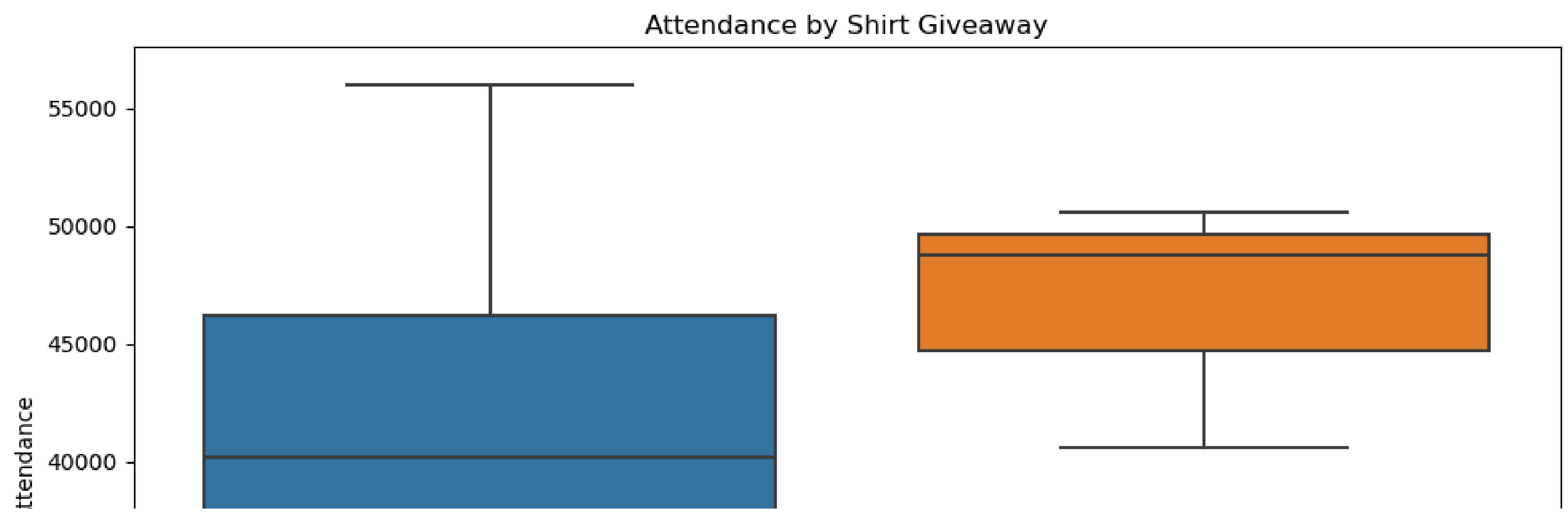


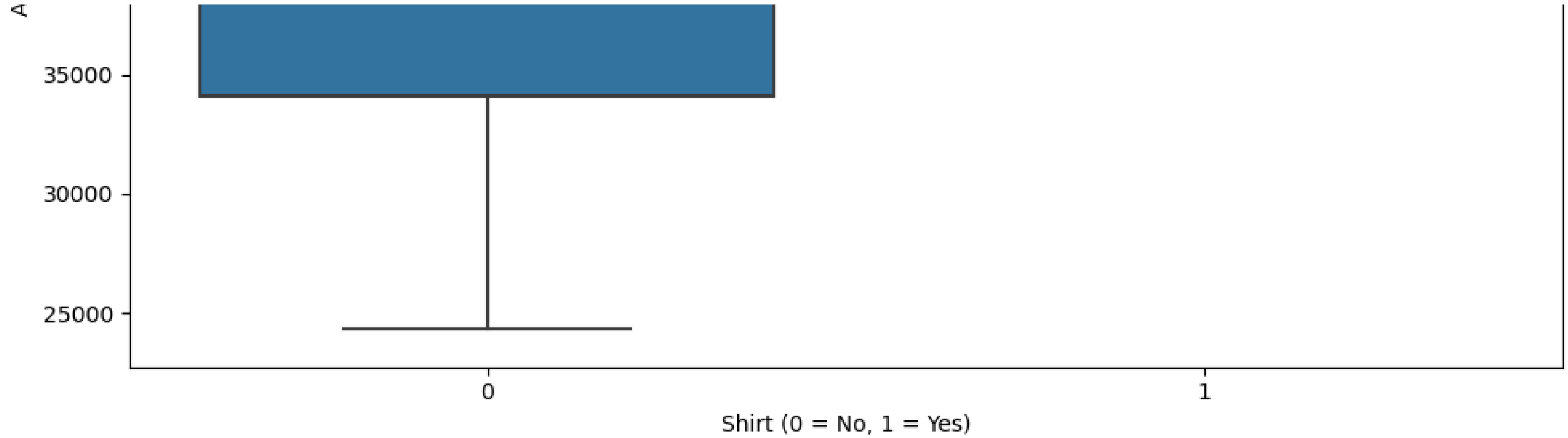
Analyzing Attendance by Promotional Events

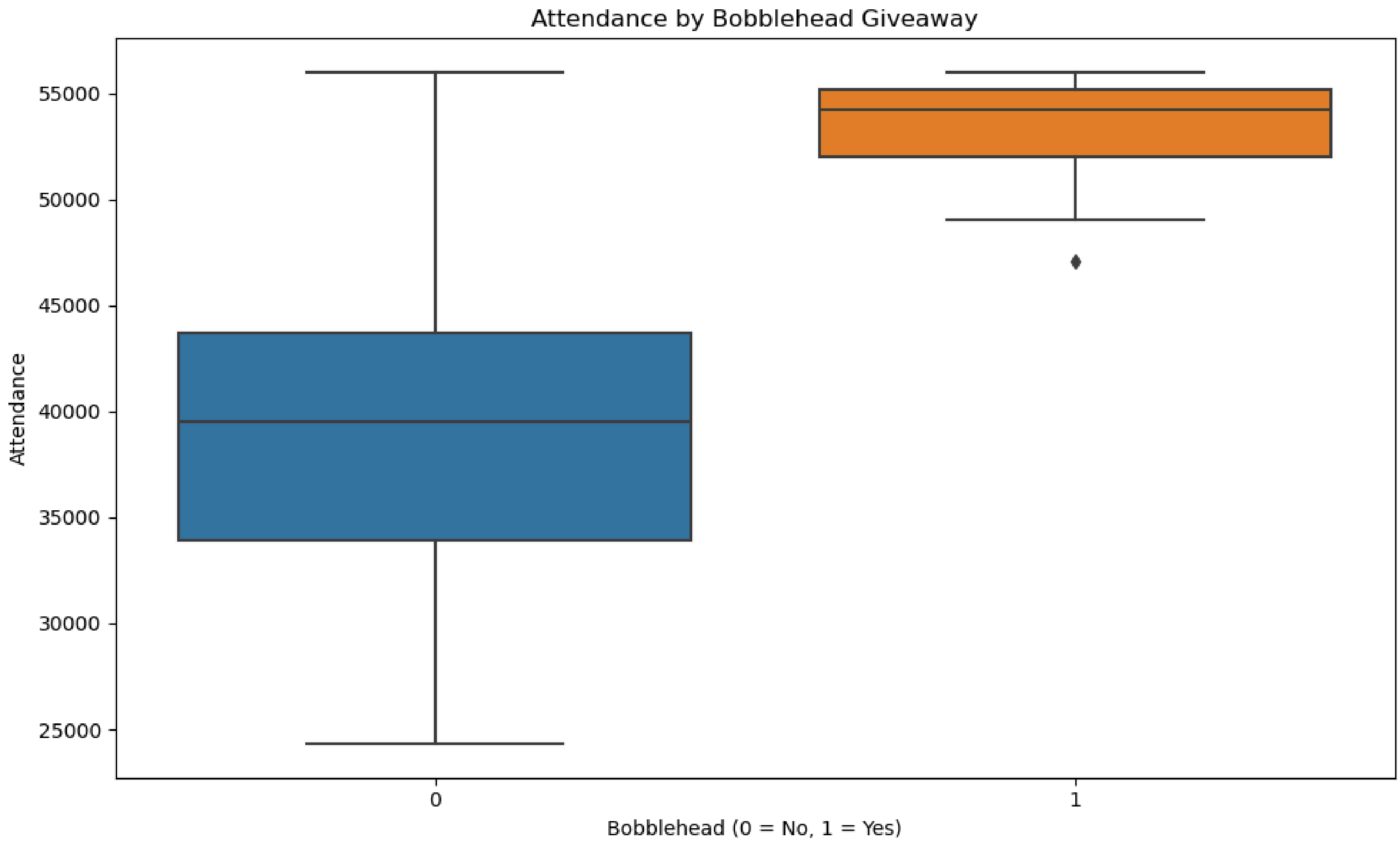
In [10]:

```
# Plots attendance by promotional events
fig, axes = plt.subplots(3, 1, figsize=(10, 18))

# Fireworks
sns.boxplot(x='fireworks', y='attend', data=mlb_df, ax=axes[0])
axes[0].set_title('Attendance by Fireworks')
axes[0].set_xlabel('Fireworks (0 = No, 1 = Yes)')
axes[0].set_ylabel('Attendance')

# Shirt
sns.boxplot(x='shirt', y='attend', data=mlb_df, ax=axes[1])
axes[1].set_title('Attendance by Shirt Giveaway')
axes[1].set_xlabel('Shirt (0 = No, 1 = Yes)')
axes[1].set_ylabel('Attendance')

# Bobblehead
sns.boxplot(x='bobblehead', y='attend', data=mlb_df, ax=axes[2])
axes[2].set_title('Attendance by Bobblehead Giveaway')
axes[2].set_xlabel('Bobblehead (0 = No, 1 = Yes)')
axes[2].set_ylabel('Attendance')

plt.tight_layout()
plt.show()
```


Attendance by Fireworks
55000
50000
45000
40000
35000
30000
25000
Attendance
0
1
Fireworks (0 = No, 1 = Yes)


Attendance by Shirt Giveaway
55000
50000
45000
40000
ttendance


35000
30000
25000
0
1
Shirt (0 = No, 1 = Yes)


Attendance by Bobblehead Giveaway
Attendance
55000
50000
45000
40000
35000
30000
25000
0
1
Bobblehead (0 = No, 1 = Yes)

OLS Regression Model

In [11]:
```
# OLS Regression Model
X = mlb_df[['day_of_week', 'temp', 'skies', 'day_night', 'cap', 'shirt', 'fireworks', 'bobblehead']]
X = sm.add_constant(X)  # Add a constant term for the intercept
y = mlb_df['attend']

model = sm.OLS(y, X).fit()
print(model.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:                 attend   R-squared:                       0.435
Model:                            OLS   Adj. R-squared:                  0.372
Method:                 Least Squares   F-statistic:                     6.925
Date:                Wed, 31 Jul 2024   Prob (F-statistic):           1.00e-06
Time:                        17:01:57   Log-Likelihood:                -822.24
No. Observations:                  81   AIC:                             1662.
Df Residuals:                      72   BIC:                             1684.
Df Model:                           8
Covariance Type:            nonrobust
===============================================================================
                  coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------
const        3.594e+04   8181.420      4.393      0.000    1.96e+04    5.22e+04
day_of_week   437.3228    418.539      1.045      0.300    -397.019    1271.665
temp           35.3887     97.514      0.363      0.718    -159.002     229.780
skies        -903.6655   1877.887     -0.481      0.632   -4647.165    2839.834
day_night   -2482.4928   2407.584     -1.031      0.306   -7281.924    2316.938
cap          -732.5436   4807.409     -0.152      0.879   -1.03e+04    8850.850
shirt        8305.8134   3954.428      2.100      0.039     422.805    1.62e+04
fireworks    3222.8209   2191.802      1.470      0.146   -1146.456    7592.098
bobblehead   1.568e+04   2264.179      6.923      0.000    1.12e+04    2.02e+04
==============================================================================
Omnibus:                        4.411   Durbin-Watson:                   2.015
Prob(Omnibus):                  0.110   Jarque-Bera (JB):                3.773
Skew:                           0.515   Prob(JB):                        0.152
Kurtosis:                       3.240   Cond. No.                         837.
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

Final insights and recomendations

Based on the OLS regression results, several key insights can be derived to recommend strategies for improving crowd attendance. Promotional events, particularly shirt and bobblehead giveaways, have a significant positive impact on attendance. The regression model shows that shirt giveaways can boost attendance by approximately 8,305 people, and bobblehead giveaways have an even more substantial effect, increasing attendance by around 15,680 people. Although fireworks nights show a positive trend in increasing attendance, this effect is not statistically significant.

The analysis suggests less significant effects from the day of the week, temperature, and sky conditions on attendance. The coefficients for these variables are not statistically significant, indicating that they have a weaker or negligible influence on the number of attendees. Similarly, the preference for day versus night games is not clear, as the regression results do not show a significant impact. Interestingly, cap giveaways appear to have a negative coefficient, suggesting they may not be effective in drawing larger crowds.

To enhance attendance, increasing the frequency of highly effective promotional events like bobblehead and shirt giveaways is recommended. These events should be heavily marketed to attract more fans and create a vibrant game-day atmosphere. While the day of the week and game timing do not show significant effects in this model, further experiments or surveys could reveal preferences among different fan segments. Weather factors, such as temperature and sky conditions, seem less critical and thus should not be a primary concern in scheduling games.

In [ ]:

```

```