notebook_unit

February 1, 2025

1 Troop Booth Signups Analysis

This notebook loads data from (which contains columns such as **Troop**, **Slot Start Time**, **Slot End Time**) and performs statistical analysis focused on the number of booth signup events per troop. In addition, the notebook identifies and labels potential outliers in the distribution of booth signup counts.

[34]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

# Define the path to the data file
data_file = "data/2025_booth_signups_unit.csv"

# Set up plotting style
sns.set(style="whitegrid")
plt.rcParams['figure.figsize'] = (10, 6)

# Load the CSV file (with header)
df = pd.read_csv(data_file)

# Convert time columns to datetime objects
df['Slot Start Time'] = pd.to_datetime(df['Slot Start Time'], format='%Y/%m/%d␣
 ↪%H:%M:%S', errors='coerce')
df['Slot End Time']   = pd.to_datetime(df['Slot End Time'], format='%Y/%m/%d %H:
 ↪%M:%S', errors='coerce')

# Display the first few rows
print("Data preview:")
df.head()
```

```
Data preview:
```

[34]:

```
   Troop           Troop Email     Slot Start Time       Slot End Time  \
0   3822      naldaz08@yahoo.com 2000-01-01 14:00:00 2000-01-01 16:00:00
1   3822      naldaz08@yahoo.com 2000-01-01 16:00:00 2000-01-01 18:00:00
2   3065  j.savage13@hotmail.com 2000-01-01 10:00:00 2000-01-01 12:00:00
```

```
3   3065  j.savage13@hotmail.com 2000-01-01 14:00:00 2000-01-01 16:00:00
4   3799      azchesko@gmail.com 2000-01-01 10:00:00 2000-01-01 12:00:00

    When Selected Date   When Selected Time              User Selecting
0  2025/01/16 20:14:31  2025/01/16 20:14:31          naldaz08@yahoo.com
1  2025/01/16 20:14:31  2025/01/16 20:14:31          naldaz08@yahoo.com
2  2025/01/14 20:02:38  2025/01/14 20:02:38  kaitlyn.redfield@gmail.com
3  2025/01/14 20:03:02  2025/01/14 20:03:02  kaitlyn.redfield@gmail.com
4  2025/01/14 20:02:12  2025/01/14 20:02:12          azchesko@gmail.com
```

[35]:

```python
# Group by Troop and count the number of signup events per troop
troop_counts = df.groupby('Troop').size().reset_index(name='Num_Booths')

# Sort by number of booths (signup events)
troop_counts.sort_values('Num_Booths', ascending=False, inplace=True)
print("Booth signup counts per troop:")
print(troop_counts)
```

```
Booth signup counts per troop:
    Troop  Num_Booths
20   3829          85
0     872          68
16   3822          59
21   3839          31
12   3475          29
6    2820          22
7    2877          20
15   3819          19
11   3315          19
8    3065          18
22   3997          16
17   3824          16
9    3296          16
13   3630          13
1    2554          11
23   4208          11
19   3828          10
24   7223           9
14   3799           8
5    2674           8
10   3312           6
4    2626           5
25   9670           4
18   3827           3
3    2603           3
2    2570           1
```

[36]:

```
# Compute descriptive statistics
desc_stats = troop_counts['Num_Booths'].describe()
print("\nDescriptive statistics for booth signups per troop:")
print(desc_stats)

Q1 = troop_counts['Num_Booths'].quantile(0.25)
Q3 = troop_counts['Num_Booths'].quantile(0.75)
IQR = Q3 - Q1

lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

print(f"Q1: {Q1}, Q3: {Q3}, IQR: {IQR}")
print(f"Lower bound: {lower_bound}, Upper bound: {upper_bound}")

# Identify outlier troops
outliers = troop_counts[(troop_counts['Num_Booths'] < lower_bound) |␣
 ↪(troop_counts['Num_Booths'] > upper_bound)]
print("\nOutlier troops (by number of booth signups):")
print(outliers)
```

```
Descriptive statistics for booth signups per troop:
count    26.000000
mean     19.615385
std      20.632163
min       1.000000
25%       8.000000
50%      14.500000
75%      19.750000
max      85.000000
Name: Num_Booths, dtype: float64
Q1: 8.0, Q3: 19.75, IQR: 11.75
Lower bound: -9.625, Upper bound: 37.375

Outlier troops (by number of booth signups):
    Troop  Num_Booths
20   3829          85
0     872          68
16   3822          59
```

1.1 5. Visualization with Outlier Labels

Below is a boxplot of the booth signup counts per troop. In addition, we overlay a stripplot (with jitter) for each troop and label the outlier points with the corresponding troop number. We also rescale the x-axis so that the non-outlier data is not bunched up.

[37]:

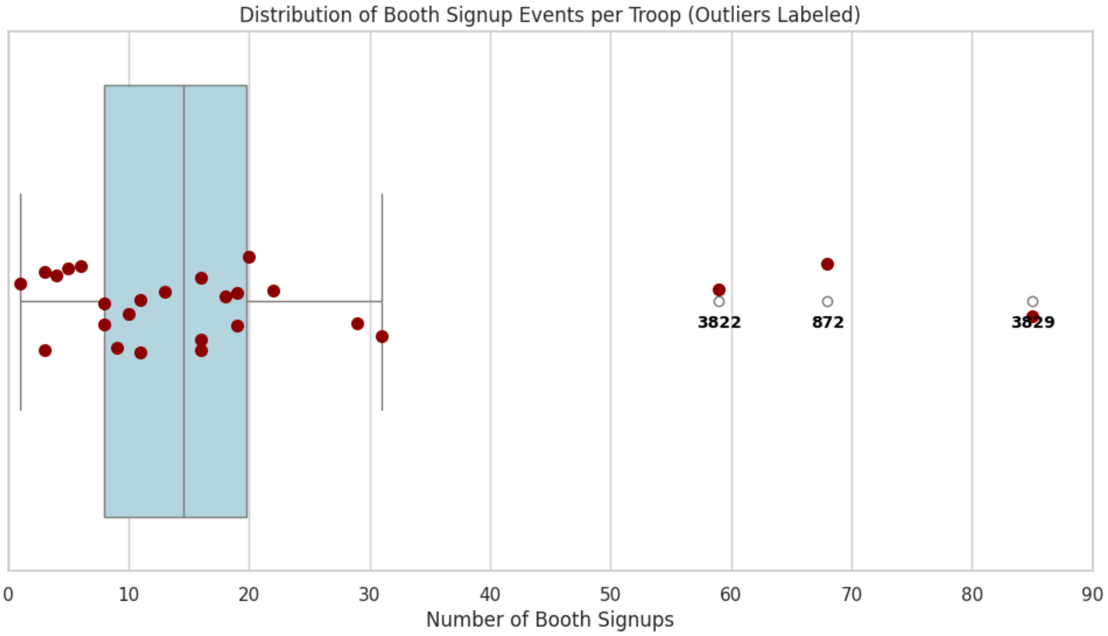
```
plt.figure(figsize=(12,6))

# Create a horizontal boxplot (vertical orientation) with the signup counts.
ax = sns.boxplot(x='Num_Booths', data=troop_counts, color='lightblue')
sns.stripplot(x='Num_Booths', data=troop_counts, color='darkred', size=8,␣
 ↪jitter=True, ax=ax)

# Extend the x-axis: set the limit from 0 to (the maximum number of signups␣
 ↪among troops + a margin).
max_val = troop_counts['Num_Booths'].max()
plt.xlim(0, max_val + 5)

# Annotate outlier points with their Troop number
for index, row in troop_counts.iterrows():
    if row['Num_Booths'] < lower_bound or row['Num_Booths'] > upper_bound:
        ax.text(row['Num_Booths'], 0.05, str(row['Troop']),
                horizontalalignment='center', color='black', weight='bold',␣
 ↪fontsize=10)

plt.title('Distribution of Booth Signup Events per Troop (Outliers Labeled)')
plt.xlabel('Number of Booth Signups')
plt.show()
```



[38]:

```
# Additional Visualization: Bar Chart for Outlier Troops Only
```

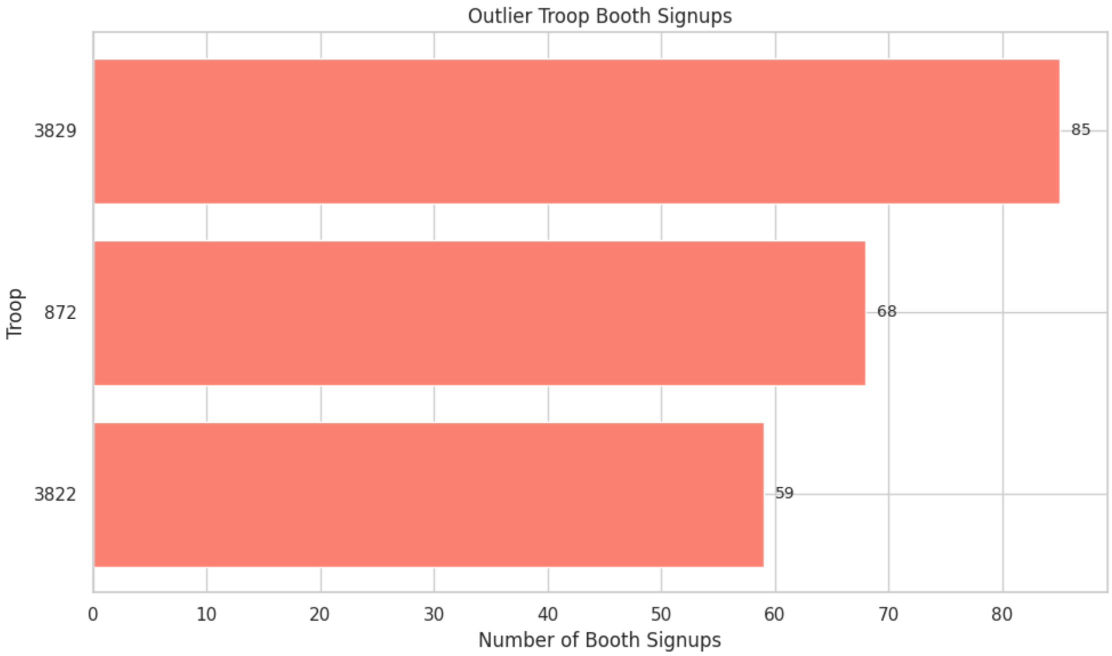
```python
# Filter the aggregated data to include only outlier troops
outlier_troops = troop_counts[(troop_counts['Num_Booths'] < lower_bound) | (troop_counts['Num_Booths'] > upper_bound)]

# If there are outliers, create a horizontal bar chart; otherwise, print a message.
if outlier_troops.empty:
    print("No outlier troops detected based on the current IQR thresholds.")
else:
    # Sort the outlier data by number of booth signups in ascending order
    outlier_troops_sorted = outlier_troops.sort_values('Num_Booths', ascending=True)

    plt.figure(figsize=(10, 6))
    # Convert the Troop column to string for better labeling on the y-axis.
    plt.barh(outlier_troops_sorted['Troop'].astype(str), outlier_troops_sorted['Num_Booths'], color='salmon')
    plt.xlabel("Number of Booth Signups")
    plt.ylabel("Troop")
    plt.title("Outlier Troop Booth Signups")

    # Annotate each bar with its signup count, with a small horizontal offset
    for i, (troop, count) in enumerate(zip(outlier_troops_sorted['Troop'], outlier_troops_sorted['Num_Booths'])):
        plt.text(count + 1, i, str(count), va='center', fontsize=10)

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



1.2 6. Save the Summary Data

Finally, we save the aggregated summary (the number of booth signup events per troop) to a CSV file for further reporting or analysis.

[39]:

```
output_file = 'troop_booth_summary.csv'
troop_counts.to_csv(output_file, index=False)
print(f"Summary data saved to {output_file}")
```

```
Summary data saved to troop_booth_summary.csv
```