EDA on TSA Complaints

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31 October 2024

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

In [2]:
```
# Load data
complaints_by_airport = pd.read_csv("C:/Users/kayly/OneDrive/Desktop/MSDS/DSC640/Data/complaints-by-airport.csv")
complaints_by_category = pd.read_csv("C:/Users/kayly/OneDrive/Desktop/MSDS/DSC640/Data/complaints-by-category.csv")
complaints_by_subcategory = pd.read_csv("C:/Users/kayly/OneDrive/Desktop/MSDS/DSC640/Data/complaints-by-subcategory.csv")
look_up_codes = pd.read_csv("C:/Users/kayly/OneDrive/Desktop/MSDS/DSC640/Data/iata-icao.csv")
```

Complaints by Airport

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

Out[3]:

	pdf_report_date	airport	year_month	count
0	2019-02	ABE	2015-01	0
1	2019-02	ABE	2015-02	0
2	2019-02	ABE	2015-03	0
3	2019-02	ABE	2015-04	0
4	2019-02	ABE	2015-05	2

In [4]:
```
# Drop rows with na values
complaints_by_airport.dropna(axis=0, inplace=True)
complaints_by_airport.isna().sum()
```

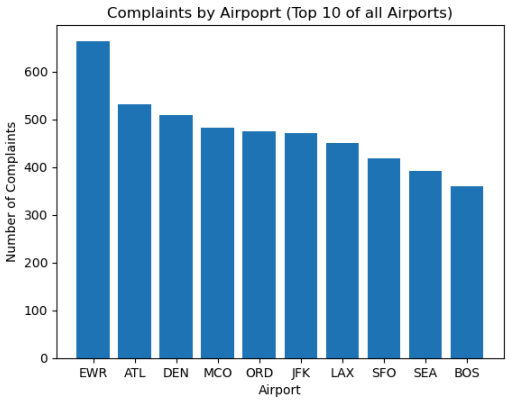
Out[4]:
```
pdf_report_date    0
airport            0
year_month         0
count              0
dtype: int64
```

In [5]:
```
# Drop pdf_report_date from complaints_by_airport
complaints_by_airport = complaints_by_airport.drop('pdf_report_date', axis=1)

# Separate year_month into year and month columns
complaints_by_airport[['year', 'month']] = complaints_by_airport['year_month'].str.split('-', expand=True)
complaints_by_airport.head()
```

Out[5]:

	airport	year_month	count	year	month
0	ABE	2015-01	0	2015	01
1	ABE	2015-02	0	2015	02
2	ABE	2015-03	0	2015	03
3	ABE	2015-04	0	2015	04
4	ABE	2015-05	2	2015	05

In [6]:
```
# Find 10 airports with the most complaints
group_by_airport = complaints_by_airport.groupby('airport').max()
group_by_airport = group_by_airport.sort_values('count', ascending=False)
group_by_airport = group_by_airport[:10]
group_by_airport.reset_index(inplace=True)

# Plot number of complaints by airport
plt.bar(group_by_airport['airport'], group_by_airport['count'])
plt.xlabel('Airport')
plt.ylabel('Number of Complaints')
plt.title('Complaints by Airpoprt (Top 10 of all Airports)')
plt.show()
```



In [ ]:

In [ ]:

Complaints by Category

In [7]:
```
complaints_by_category.head()
```

Out[7]:

	pdf_report_date	airport	category	year_month	count	clean_cat	clean_cat_status
0	2019-02	ABE	Hazardous Materials Safety	2015-01	0	Hazardous Materials Safety	original
1	2019-02	ABE	Mishandling of Passenger Property	2015-01	0	Mishandling of Passenger Property	original
2	2019-02	ABE	Hazardous Materials Safety	2015-02	0	Hazardous Materials Safety	original
3	2019-02	ABE	Mishandling of Passenger Property	2015-02	0	Mishandling of Passenger Property	original
4	2019-02	ABE	Hazardous Materials Safety	2015-03	0	Hazardous Materials Safety	original

In [8]:
```
# Drop pdf_report_date from complaints_by_airport
complaints_by_category = complaints_by_category.drop('pdf_report_date', axis=1)

# Separate year_month into year and month columns
complaints_by_category[['year', 'month']] = complaints_by_category['year_month'].str.split('-', expand=True)
complaints_by_category.head()
```

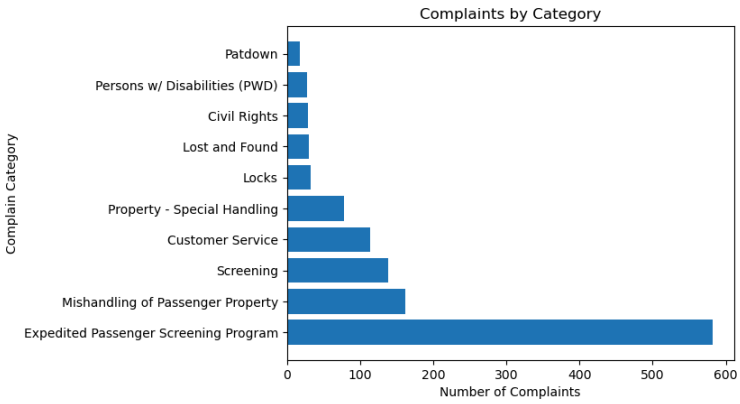
Out[8]:

	airport	category	year_month	count	clean_cat	clean_cat_status	year	month
0	ABE	Hazardous Materials Safety	2015-01	0	Hazardous Materials Safety	original	2015	01
1	ABE	Mishandling of Passenger Property	2015-01	0	Mishandling of Passenger Property	original	2015	01
2	ABE	Hazardous Materials Safety	2015-02	0	Hazardous Materials Safety	original	2015	02
3	ABE	Mishandling of Passenger Property	2015-02	0	Mishandling of Passenger Property	original	2015	02
4	ABE	Hazardous Materials Safety	2015-03	0	Hazardous Materials Safety	original	2015	03

In [9]:
```
# Drop rows with na values
complaints_by_category.dropna(axis=0, inplace=True)
complaints_by_category.isna().sum()
```

Out[9]:
```
airport            0
category           0
year_month         0
count              0
clean_cat          0
clean_cat_status   0
year               0
month              0
dtype: int64
```

In [10]:
```
# Find categories with the most complaints
group_by_category = complaints_by_category[['count', 'clean_cat']]
group_by_category = group_by_category.groupby('clean_cat').max()
group_by_category = group_by_category.sort_values('count', ascending=False)
group_by_category = group_by_category[:10]
group_by_category.reset_index(inplace=True)

# Plot number of complaints by airport
plt.barh(group_by_category['clean_cat'], group_by_category['count'])
plt.ylabel('Complain Category')
plt.xlabel('Number of Complaints')
plt.title('Complaints by Category')
plt.show()
```



In [11]:
```
# Find categories with the most complaints in airport with the most complaints
top_10_airports_category = complaints_by_category.loc[complaints_by_category['airport'].isin(['EWR', 'ATL', 'DEN', 'MCO',
                                                                                               'ORD', 'JFK', 'LAX', 'SFO',
                                                                                               'SEA', 'BOS'])]
top_10_airports_category = top_10_airports_category[['airport','count', 'clean_cat']]
top_10_airports_category = top_10_airports_category.groupby(['airport', 'clean_cat']).max()
top_10_airports_category = top_10_airports_category.sort_values('count', ascending=False)
top_10_airports_category[:10]
```

Out[11]:

		count
airport	**clean_cat**	
EWR	**Expedited Passenger Screening Program**	582
ORD	**Expedited Passenger Screening Program**	421
ATL	**Expedited Passenger Screening Program**	377
DEN	**Expedited Passenger Screening Program**	375
SFO	**Expedited Passenger Screening Program**	373
LAX	**Expedited Passenger Screening Program**	370
JFK	**Expedited Passenger Screening Program**	348
BOS	**Expedited Passenger Screening Program**	299
MCO	**Expedited Passenger Screening Program**	285
SEA	**Expedited Passenger Screening Program**	282

Looks like top airpors have the same top category of complaints; Expedited Passenger Screening Program

Complaints by Subcategory

In [12]:
```
complaints_by_subcategory.head()
```

Out[12]:

	pdf_report_date	airport	category	subcategory	year_month	count	clean_cat	clean_subcat	clean_cat_status	clean_subcat_status	is_category_prefix_removed
0	2019-02	ABE	Hazardous Materials Safety	General	2015-01	0	Hazardous Materials Safety	General	original	original	False
1	2019-02	ABE	Mishandling of Passenger Property	Damaged/Missing Items--Checked Baggage	2015-01	0	Mishandling of Passenger Property	*Damaged/Missing Items--Checked Baggage	original	original	False
2	2019-02	ABE	Hazardous Materials Safety	General	2015-02	0	Hazardous Materials Safety	General	original	original	False
3	2019-02	ABE	Mishandling of Passenger Property	Damaged/Missing Items--Checked Baggage	2015-02	0	Mishandling of Passenger Property	*Damaged/Missing Items--Checked Baggage	original	original	False
4	2019-02	ABE	Hazardous Materials Safety	General	2015-03	0	Hazardous Materials Safety	General	original	original	False

In [13]:
```
# Drop pdf_report_date from complaints_by_airport
complaints_by_subcategory = complaints_by_subcategory.drop('pdf_report_date', axis=1)

# Separate year_month into year and month columns
complaints_by_subcategory[['year', 'month']] = complaints_by_subcategory['year_month'].str.split('-', expand=True)
complaints_by_subcategory.head()
```

Out[13]:

	airport	category	subcategory	year_month	count	clean_cat	clean_subcat	clean_cat_status	clean_subcat_status	is_category_prefix_removed	year	month
0	ABE	Hazardous Materials Safety	General	2015-01	0	Hazardous Materials Safety	General	original	original	False	2015	01
1	ABE	Mishandling of Passenger Property	Damaged/Missing Items--Checked Baggage	2015-01	0	Mishandling of Passenger Property	*Damaged/Missing Items--Checked Baggage	original	original	False	2015	01
2	ABE	Hazardous Materials Safety	General	2015-02	0	Hazardous Materials Safety	General	original	original	False	2015	02
3	ABE	Mishandling of Passenger Property	Damaged/Missing Items--Checked Baggage	2015-02	0	Mishandling of Passenger Property	*Damaged/Missing Items--Checked Baggage	original	original	False	2015	02
4	ABE	Hazardous Materials Safety	General	2015-03	0	Hazardous Materials Safety	General	original	original	False	2015	03

In [14]:
```
# Drop rows with na values
complaints_by_subcategory.dropna(axis=0, inplace=True)
complaints_by_subcategory.isna().sum()
```

Out[14]:
```
airport                     0
category                    0
subcategory                 0
year_month                  0
count                       0
clean_cat                   0
clean_subcat                0
clean_cat_status            0
clean_subcat_status         0
is_category_prefix_removed  0
year                        0
month                       0
dtype: int64
```

Look Up Codes

In [15]:
```
look_up_codes
```

Out[15]:

	country_code	region_name	iata	icao	airport	latitude	longitude
0	AE	Abu Zaby	AAN	OMAL	Al Ain International Airport	24.2617	55.6092
1	AE	Abu Zaby	AUH	OMAA	Abu Dhabi International Airport	24.4330	54.6511
2	AE	Abu Zaby	AYM	NaN	Yas Island Seaplane Base	24.4670	54.6103
3	AE	Abu Zaby	AZI	OMAD	Al Bateen Executive Airport	24.4283	54.4581
4	AE	Abu Zaby	DHF	OMAM	Al Dhafra Air Base	24.2482	54.5477
...	...	...	...	...	...	...	...
8932	ZW	Masvingo	MVZ	FVMV	Masvingo Airport	-20.0553	30.8591
8933	ZW	Matabeleland North	HWN	FVWN	Hwange National Park Airport	-18.6299	27.0210
8934	ZW	Matabeleland North	VFA	FVFA	Victoria Falls Airport	-18.0959	25.8390
8935	ZW	Matabeleland North	WKI	FVWT	Hwange Town Airport	-18.3630	26.5198
8936	ZW	Midlands	GWE	FVTL	Thornhill Air Base	-19.4364	29.8619

8937 rows × 7 columns

In [16]:
```
# Drop rows with na values
look_up_codes.dropna(axis=0, inplace=True)
look_up_codes.isna().sum()
```

Out[16]:
```
country_code    0
region_name     0
iata            0
icao            0
airport         0
latitude        0
longitude       0
dtype: int64
```

Join datasets

In [17]:
```
# Set index of each dataframe
complaints_by_airport.set_index('airport', inplace=True)
complaints_by_category.set_index('airport', inplace=True)
complaints_by_subcategory.set_index('airport', inplace=True)
look_up_codes.set_index('iata', inplace=True)
```

In [18]:
```
# Join complaints_by_airport and look_up_codes by airport code
complaints_by_airport = pd.merge(look_up_codes, complaints_by_airport, left_index=True, right_index=True)
complaints_by_airport.reset_index(inplace=True)
complaints_by_airport.head()
```

Out[18]:

	iata	country_code	region_name	icao	airport	latitude	longitude	year_month	count	year	month
0	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	2015-01	0	2015	01
1	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	2015-02	0	2015	02
2	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	2015-03	0	2015	03
3	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	2015-04	0	2015	04
4	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	2015-05	2	2015	05

In [19]:
```
# Join complaints_by_category and look_up_codes by airport code
complaints_by_category = pd.merge(look_up_codes, complaints_by_category, left_index=True, right_index=True)
complaints_by_category.reset_index(inplace=True)
complaints_by_category.head()
```

Out[19]:

	iata	country_code	region_name	icao	airport	latitude	longitude	category	year_month	count	clean_cat	clean_cat_status	year	month
0	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Hazardous Materials Safety	2015-01	0	Hazardous Materials Safety	original	2015	01
1	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Mishandling of Passenger Property	2015-01	0	Mishandling of Passenger Property	original	2015	01
2	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Hazardous Materials Safety	2015-02	0	Hazardous Materials Safety	original	2015	02
3	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Mishandling of Passenger Property	2015-02	0	Mishandling of Passenger Property	original	2015	02
4	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Hazardous Materials Safety	2015-03	0	Hazardous Materials Safety	original	2015	03

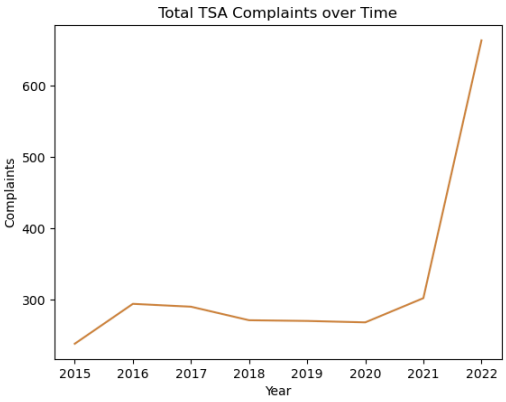
In [20]:
```
# Join complaints_by_subcategory and look_up_codes by airport code
complaints_by_subcategory = pd.merge(look_up_codes, complaints_by_subcategory, left_index=True, right_index=True)
complaints_by_subcategory.reset_index(inplace=True)
complaints_by_subcategory.head()
```

Out[20]:

	iata	country_code	region_name	icao	airport	latitude	longitude	category	subcategory	year_month	count	clean_cat	clean_subcat	clean_cat_status	clean_subcat_status	is_category_prefix_removed
0	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Hazardous Materials Safety	General	2015-01	0	Hazardous Materials Safety	General	original	original	False
1	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Mishandling of Passenger Property	Damaged/Missing Items--Checked Baggage	2015-01	0	Mishandling of Passenger Property	*Damaged/Missing Items--Checked Baggage	original	original	False
2	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Hazardous Materials Safety	General	2015-02	0	Hazardous Materials Safety	General	original	original	False
3	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Mishandling of Passenger Property	Damaged/Missing Items--Checked Baggage	2015-02	0	Mishandling of Passenger Property	*Damaged/Missing Items--Checked Baggage	original	original	False
4	ABE	US	Pennsylvania	KABE	Lehigh Valley International Airport	40.6521	-75.4408	Hazardous Materials Safety	General	2015-03	0	Hazardous Materials Safety	General	original	original	False

Visual Exploration

In [51]:
```
# Calculate number of complaints by year for all airports
complaints_by_year = complaints_by_airport[['year', 'count']]
complaints_by_year = complaints_by_year.groupby('year')['count'].max().reset_index()

# Remove 2023 ane 2024 values
complaints_by_year = complaints_by_year[complaints_by_year['year'] != '2023']
complaints_by_year = complaints_by_year[complaints_by_year['year'] != '2024']

# Plot number of complaints by year for all airports
plt.plot(complaints_by_year['year'], complaints_by_year['count'], color='peru')
plt.xlabel('Year')
plt.ylabel('Complaints')
plt.title('Total TSA Complaints over Time')
plt.show()
```



There is a huge peak in complaints in 2022. Complaints then decrease in both 2023 and 2024, but not to the level they were at in 2021.

What happened in 2022 that caused so many complaints?

Correlation of Count of TSA complaints with different variables

In [61]:
```
# Select columns to go into correlation table
correlation_columns = complaints_by_category.loc[:, ('iata', 'region_name', 'icao', 'airport', 'category', 'year', 'month','count')]

# Recode iata, icao, region name, and category as numerical values to include in correlation table
correlation_columns['iata'] = pd.factorize(correlation_columns['iata'])[0]
correlation_columns['region_name'] = pd.factorize(correlation_columns['region_name'])[0]
correlation_columns['icao'] = pd.factorize(correlation_columns['icao'])[0]
correlation_columns['airport'] = pd.factorize(correlation_columns['airport'])[0]
```

```
correlation_columns['category'] = pd.factorize(correlation_columns['category'])[0]
correlation_columns
```

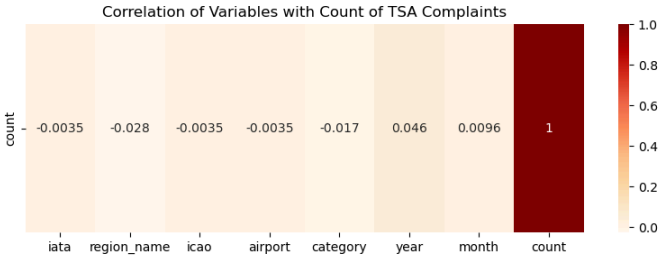
Out[61]:

	iata	region_name	icao	airport	category	year	month	count
0	0	0	0	0	0	2015	01	0
1	0	0	0	0	1	2015	01	0
2	0	0	0	0	0	2015	02	0
3	0	0	0	0	1	2015	02	0
4	0	0	0	0	0	2015	03	0
...	...	...	...	...	...	...	...	...
236451	441	33	441	441	6	2015	11	0
236452	441	33	441	441	17	2015	12	1
236453	441	33	441	441	1	2015	12	0
236454	441	33	441	441	9	2015	12	0
236455	441	33	441	441	6	2015	12	0

236456 rows × 8 columns

In [62]:
```
# Correlation matrix of each feature with quality
plt.figure(figsize=(10,3))
sns.heatmap(correlation_columns.corr().loc[['count'],:],annot=True,cmap='OrRd',cbar=True)
plt.title('Correlation of Variables with Count of TSA Complaints')
```

Out[62]: `Text(0.5, 1.0, 'Correlation of Variables with Count of TSA Complaints')`



There is not a strong correlation of any one variable with count of TSA complaints. This indicates we cannot drastically reduce complaints by focusing only in one area.

IATA, ICAO, and airport all have the exact same correlation with count. This is because They are different ways variables that tell the same thing, in the future only one of these variables needs to be examined.

Number of Complaints by State

In [24]:
```
# Find max complaints for each state in 2022
complaints_by_subcategory_state = complaints_by_subcategory.loc[complaints_by_subcategory['year'] == '2022']
complaints_by_subcategory_state = complaints_by_subcategory[['region_name', 'count']]
complaints_by_subcategory_state = complaints_by_subcategory_state.groupby(['region_name']).max().reset_index()
complaints_by_subcategory_state
```

Out[24]:

	region_name	count
0	Alabama	21
1	Alaska	32
2	Arizona	193
3	Arkansas	23
4	Barrigada	13
...	...	...
58	Virginia	194
59	Washington	274
60	West Virginia	4
61	Wisconsin	39
62	Wyoming	10

63 rows × 2 columns

In [25]:
```
# List of state names
state_names = ["Alaska", "Alabama", "Arkansas", "American Samoa", "Arizona", "California", "Colorado", "Connecticut", "District ", "of Columbia", "Delaware", "Florida", "Georgia", "Guam", "Hawaii", "Iowa",

# Remove regions that are not states in US
complaints_by_subcategory_state = complaints_by_subcategory_state[complaints_by_subcategory_state['region_name'].isin(state_names)]
complaints_by_subcategory_state.head()

# Export to r
complaints_by_subcategory_state.to_csv('complaints_by_subcategory_state.csv', index=False)
```

In [26]:
```
# Import from r with abbreviations
complaints_by_subcategory_state_abb = pd.read_csv("C:/Users/kayly/OneDrive/Desktop/MSDS/DSC640/complaints_by_subcategory_state_abb.csv")
complaints_by_subcategory_state_abb.drop('Unnamed: 0', axis=1, inplace=True)
complaints_by_subcategory_state_abb.head()
```

Out[26]:

	region_name	count	abbreviation
0	Alabama	21	AL
1	Alaska	32	AK
2	Arizona	193	AZ
3	Arkansas	23	AR
4	California	361	CA

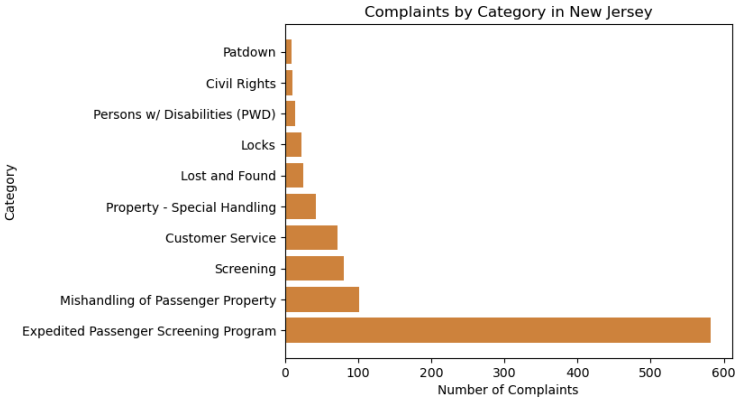
In [36]:
```
# Choropleth of number of complaints by state in 2022

import plotly
import plotly.express as px

# create figure
fig = px.choropleth(complaints_by_subcategory_state_abb, locations='abbreviation',
```

```
                    locationmode="USA-states", color='count', scope="usa", color_continuous_scale="OrRd")
fig.update_layout(
    title_text = '2022 TSA Complaints by State')
fig.show()
```

New Jersey was the state with the most complaints in 2022.

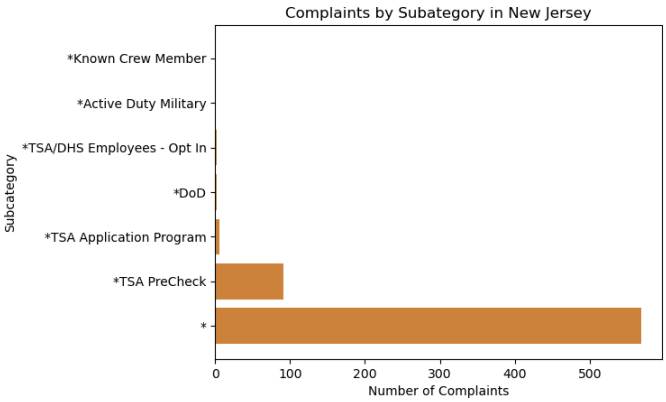
Complaints by Category in New Jersey

In [64]:
```
# Find categories with the most complaints in New Jersey
group_gy_category = complaints_by_category.loc[complaints_by_category['region_name'] == 'New Jersey']
group_by_category = group_gy_category[['count', 'clean_cat']]
group_by_category = group_by_category.groupby('clean_cat').max()
group_by_category = group_by_category.sort_values('count', ascending=False)
group_by_category = group_by_category[:10]
group_by_category.reset_index(inplace=True)

# Plot number of complaints by category
plt.barh(group_by_category['clean_cat'], group_by_category['count'], color = 'peru')
plt.ylabel('Category')
plt.xlabel('Number of Complaints')
plt.title('Complaints by Category in New Jersey')
plt.show()
```



Complaints by Subcategory in New Jersey

In [42]:
```
# Look at count of subcategory in New Jersey when category is Expedited Passenger Screening Program
group_by_subcategory = complaints_by_subcategory.loc[complaints_by_subcategory['region_name'] == 'New Jersey']
group_by_subcategory = group_by_subcategory.loc[group_by_subcategory['category']=='Expedited Passenger Screening Program']
group_by_subcategory = group_by_subcategory[['count', 'clean_subcat']]
group_by_subcategory = group_by_subcategory.groupby('clean_subcat').max()
group_by_subcategory = group_by_subcategory.sort_values('count', ascending=False)
group_by_subcategory.reset_index(inplace=True)
group_by_subcategory

# Plot number of complaints by subcategory
plt.barh(group_by_subcategory['clean_subcat'], group_by_subcategory['count'], color = 'peru')
plt.ylabel('Subcategory')
plt.xlabel('Number of Complaints')
plt.title('Complaints by Subategory in New Jersey')
plt.show()
```



The * indicates the subcategory is ambigious so we cannot gain any more insights from this. The best we can say is that the category responsible for the most complaints is Expidited Screening Passenger Programs.

In the future, it would be useful to have less ambigious subcategories so actionable inisghts can be drawn from data collected.

Complaints by Month

In [30]:
```
# Boxplot of number of complaints by month for New Jersey
```

In [31]:
```
# Find number of complaints in each month for each year
new_jersey_by_month = complaints_by_airport.loc[complaints_by_airport['region_name'] == 'New Jersey']
new_jersey_by_month = new_jersey_by_month[['count', 'month', 'year']]
new_jersey_by_month = new_jersey_by_month.groupby(['month','year']).max()
new_jersey_by_month.reset_index(inplace=True)
new_jersey_by_month
```

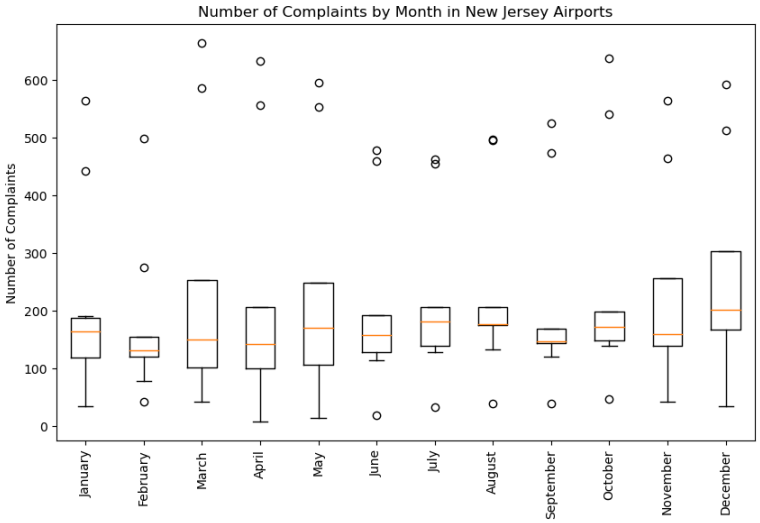
Out[31]:

	month	year	count
0	01	2015	103
1	01	2016	172
2	01	2017	190
3	01	2018	154
4	01	2019	109
...	...	...	...
104	12	2019	201
105	12	2020	34
106	12	2021	302
107	12	2022	591
108	12	2023	512

109 rows × 3 columns

In [32]:
```
January = new_jersey_by_month.loc[new_jersey_by_month['month']=='01']
February = new_jersey_by_month.loc[new_jersey_by_month['month']=='02']
March = new_jersey_by_month.loc[new_jersey_by_month['month']=='03']
April = new_jersey_by_month.loc[new_jersey_by_month['month']=='04']
May = new_jersey_by_month.loc[new_jersey_by_month['month']=='05']
June = new_jersey_by_month.loc[new_jersey_by_month['month']=='06']
July = new_jersey_by_month.loc[new_jersey_by_month['month']=='07']
August = new_jersey_by_month.loc[new_jersey_by_month['month']=='08']
September = new_jersey_by_month.loc[new_jersey_by_month['month']=='09']
October = new_jersey_by_month.loc[new_jersey_by_month['month']=='10']
November = new_jersey_by_month.loc[new_jersey_by_month['month']=='11']
December = new_jersey_by_month.loc[new_jersey_by_month['month']=='12']
```

In [33]:
```
columns = [January['count'], February['count'], March['count'], April['count'], May['count'], June['count'],
           July['count'], August['count'], September['count'], October['count'], November['count'], December['count']]

plt.figure(figsize=(10, 6))
plt.boxplot(columns, labels = ['January', 'February', 'March', 'April', 'May', 'June', 'July', 'August', 'September',
                               'October', 'November', 'December'])
plt.xticks(rotation=90)
plt.ylabel('Number of Complaints')
plt.title('Number of Complaints by Month in New Jersey Airports')
plt.show()
```



On average, December has the most complaints.

Conclusions

TSA complaints are frequent and they must be reduced. Travelers are spending large amounts of money to travel through our airports, we should want to provide them with better service than we have been.

We began by looking at the number of reported complaints per year. 2022 had the highest number of complaints. Since then, complaints have reduced but not to below COVID numbers. We wanted to understand what is causing these complaints. Our first search was to see if any variables (region, airport, complaint category, etc.) had a correlation with the number of complaints. If any of them did, we would know where to begin work. However, no categories had a strong correlation.

From there we wanted to understand if any area in particular had more complaints than other. Viewing a map of the USA color-coded for complaint number revealed New Jersey has significantly more complaints than other states. From here, we chose to dive further into the data on New Jersey to discover ways to reduce complaints.

In New Jersey, we found most complaints fell under the category 'Expedited Passenger Screening Program'. This indicates customers are usually complaining that they are waiting too long to get through required checkpoints within the airport. There are many checkpoints that could be causing this, so we tried to understand if there is a specific area customers complain about more. To do this, we examined the number of complaints by subcategory. Unfortunately, this did not yield any useful data because the subcategories listed on the complaint form are not specific enough.

A final aspect we examined was how complaints change throughout the year. We found that over the past 10 years on avearge, December ha the most complaints. This is likely due to a higher number of travelers in the airport during this time.

Recommendations

1. Increase staffing at major checkpoints (baggage drop off, security, customs, etc.): An increase in staff will allow more customers to be helped at once, reducing their wait time.
2. Increase number of scanners at security checkpoints: Again this will reduce wait time for customers
3. Update TSA complaints form to have better subcategory options. This will lead to better understanding of where to put resources

Recommendations 1 and 2 will be costly, however the cost will be outweiged by the gain in customers. If customers have a bette experience at the airport, they will be more likely to fly than drive which will increase profits.

In [ ]: