In [168]:

```
# Paths
player_data_path = "/Users/aryandaga/Desktop/game_state_frame_data.parquet"
output_path = "/Users/aryandaga/Desktop/output_path.parquet"
```

In [169]:

```
#Libraries
import pandas as pd
import matplotlib.path as pth
```

In [170]:

```
class ProcessGameState:
    def __init__(self, player_data_path):
        self.data = pd.read_parquet(player_data_path, engine='pyarrow')

    def in_boundary(self, boundary_points, point, z_bounds):
        boundary = pth.Path(boundary_points)
        x, y, z = point
        z_min, z_max = z_bounds
        return (boundary.contains_point([x,y])) and (z_min <= z <= z_max)

    def filter_by(self, trait, trait_value, output_path):
        filtered_row = []
        for _,row in self.data.iterrows():
            if row[trait] == trait_value:
                filtered_row.append(row)
        df = pd.DataFrame(filtered_row)
        df.to_parquet(output_path, engine='pyarrow')

    def extract_weapon_classes(self, row):
        weapon_classes = []
        if row['inventory'] is None:
            return weapon_classes
        else:
            for item in row['inventory']:
                weapon_classes.append(item.get('weapon_class'))
        return weapon_classes
```

In [171]:

```
# a)  Is entering via the light blue boundary a common strategy used by Team2 on T (
p1 = ProcessGameState(player_data_path)
z_bounds = (285, 421) # z coordinates for
boundary_points = [[-1735, 250], [-2024, 398], [-2806, 742], [-2472, 1233], [-1565,
p1.filter_by('side', 'T', output_path) # filters list based on side (T or CT)
p2 = ProcessGameState(output_path)
p2.filter_by('team', 'Team2', output_path) # filters list based on team (Team1 or Te
p3 = ProcessGameState(output_path)

p3.data = p3.data.sort_values('round_num')

# For loop that goes through filtered list and counts if team2 enters boundary in di
true_rounds = [] #Contains rounds where the boundary was entered
all_rounds = p3.data['round_num'].unique() # contains rounds in sorted list
for _,row in p3.data.iterrows():
    if not (row['round_num'] in true_rounds) and p3.in_boundary(boundary_points, (ro
        true_rounds.append(row['round_num'])
print(len(true_rounds), len(all_rounds))
# Output is: (1, 15)

'''
Answer: We can say from the above output (1,15) that entering through the light blue
strategy used by Team2 on T side as team2 entered the blue area only 1 round in 15 r
'''
```

```
1 15
```

Out[171]:

```
"\nAnswer: We can say from the above output (1,15) that entering throu
gh the light blue boundary isn't a common\nstrategy used by Team2 on T
side as team2 entered the blue area only 1 round in 15 rounds. \n"
```

In [172]:

```
# b. What is the average timer that Team2 on T (terrorist) side enters “BombsiteB” w
p1 = ProcessGameState(player_data_path)
p1.filter_by('side', 'T', output_path) # filters list based on side (T or CT)
p2 = ProcessGameState(output_path)
p2.filter_by('team', 'Team2', output_path) # filters list based on team (Team1 or Te
p3 = ProcessGameState(output_path)

p3.data = p3.data.sort_values('round_num')

count = 0
gun_list = []
processed_player = []
processed_rounds = []
all_rounds = p3.data['round_num'].unique()
for _, row in p3.data.iterrows():
    if not (row['round_num'] in processed_rounds):
        if not row['player'] in processed_player:
            processed_player.append(row['player'])
            gun_list.extend(p3.extract_weapon_classes(row))
        if len(processed_player) == 5:
            print(gun_list)
            if gun_list.count('Rifle') + gun_list.count('SMGs') >= 2:
                count = count + 1
            processed_player = []
            gun_list = []
            processed_rounds.append(row['round_num'])

print(count, len(all_rounds))
# Output for the above is (10, 15)

'''
From the above output we can say that the average time that Team2 on T side enters B
or SMGS is 10/15 which is majority of the time or 66.66% of the times
'''
```

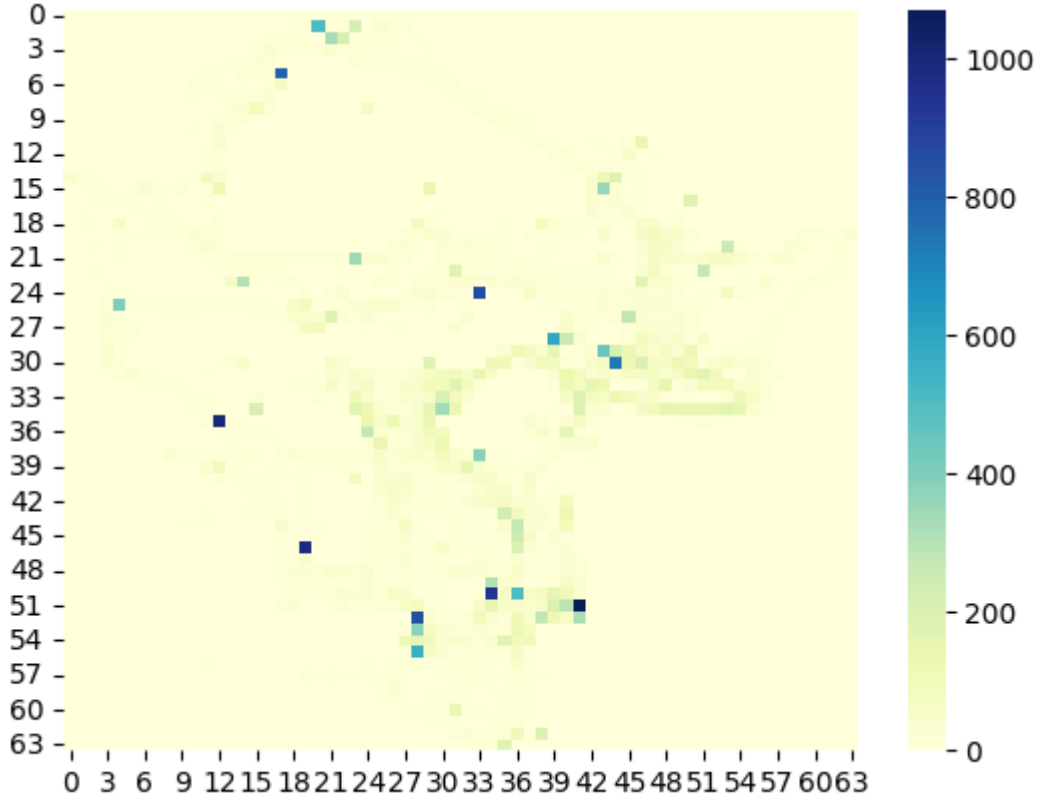
```
['Pistols', 'Pistols', 'Pistols', 'Pistols', 'Pistols']
['Grenade', 'Pistols', 'Rifle', 'Grenade', 'Grenade', 'Pistols', 'Rifl
e', 'Pistols', 'Rifle', 'Grenade', 'Grenade', 'Grenade', 'Pistols', 'R
ifle', 'Grenade', 'Rifle', 'Grenade', 'Pistols']
['Grenade', 'Pistols', 'Rifle', 'Grenade', 'Pistols', 'Grenade', 'Rifl
e', 'Grenade', 'Grenade', 'Grenade', 'Grenade', 'Pistols', 'Rifle', 'G
renade', 'Grenade', 'Grenade', 'Grenade', 'Pistols', 'Rifle']
['Grenade', 'Grenade', 'Rifle', 'Grenade', 'Pistols', 'Pistols', 'Rifl
e', 'Grenade', 'Pistols', 'Rifle', 'Grenade']
['Pistols', 'Pistols', 'Pistols', 'Pistols']
['Pistols', 'Rifle', 'Grenade', 'Pistols', 'Rifle', 'Grenade', 'Rifl
e', 'Pistols', 'Grenade', 'Pistols', 'Rifle']
['Rifle', 'Pistols', 'Pistols', 'Rifle', 'Pistols']
['Pistols', 'Rifle', 'Rifle', 'Grenade', 'Pistols']
['Grenade', 'Grenade', 'Pistols', 'Rifle', 'Pistols', 'Rifle', 'Grenad
e', 'Pistols', 'Rifle']
['Pistols', 'Pistols', 'Grenade']
['Pistols', 'Rifle', 'Grenade', 'Grenade', 'Pistols', 'Rifle', 'Pistol
s', 'Rifle', 'Grenade', 'Grenade', 'Rifle', 'Pistols', 'Grenade', 'Gre
nade', 'Pistols', 'Rifle', 'Grenade']
['Pistols', 'Pistols']
['Pistols', 'Rifle', 'Grenade']
['Pistols', 'Rifle', 'Grenade', 'Grenade', 'Rifle', 'Pistols', 'Pistol
s', 'Rifle', 'Rifle', 'Grenade', 'Grenade', 'Grenade', 'Grenade', 'Pis
tols']
['Rifle', 'Grenade', 'Grenade', 'Pistols', 'Rifle', 'Grenade', 'Pistol
s', 'Pistols', 'Rifle', 'Rifle', 'Pistols']
10 15
```

Out[172]:

```
'\nFrom the above output we can say that the average time that Team2 o
n T side enters BombsideB with atleast 2 rifles\nor SMGS is 10/15 whic
h is majority of the time or 66.66% of the times\n'
```

In [173]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
#c. Now that we've gathered data on Team2 T side, let's examine their CT (counter-te
# staff where you suspect them to be waiting inside "BombsiteB" i. Hint: Try a heatm

p1 = ProcessGameState(player_data_path)
p1.filter_by('side', 'CT', output_path) # filters list based on side (T or CT)
p2 = ProcessGameState(output_path)
p2.filter_by('team', 'Team1', output_path) # filters list based on team (Team1 or Te
p3 = ProcessGameState(output_path)

# Create a dictionary to store the player coordinates per round
round_coordinates = {}

for _, row in p3.data.iterrows():
    round_num = row['round_num']
    player_coordinates = (row['x'], row['y'])

    if round_num not in round_coordinates:
        round_coordinates[round_num] = []
    round_coordinates[round_num].append(player_coordinates)

# Now, create the heatmap with seaborn
all_coordinates = [coord for sublist in round_coordinates.values() for coord in subl
df = pd.DataFrame(all_coordinates, columns=['x', 'y'])

# Calculate the 2d histogram for the data
heatmap_data, xedges, yedges = np.histogram2d(df['x'], df['y'], bins=(64,64))

# Create the heatmap using seaborn
ax = sns.heatmap(heatmap_data, cmap="YlGnBu")

# Show the plot
plt.show()

'''
Answer: We can see from the plot that the area with bluest dotes is the place where
of the time
'''
```



Out[173]:

'\nAnswer: We can see from the plot that the area with bluest dotes is the place where enemies are situated most\nof the time\n'

In [174]:

```
'''
Problem 3

3. (No Coding) Most of the time, our stakeholders (in this case, the CS:GO
coaching staff) aren't tech-savvy enough to run code themselves. Propose a
solution to your product manager that:
a. could allow our coaching staff to request or acquire the output themselves
b. takes less than 1 weeks worth of work to implement


Answer: To empower the coaching staff to access and interpret strategic insights wit
needing to run the code themselves, we suggest developing an intuitive, user-friendl
This web dashboard, equipped with comprehensive data visualization tools,
will allow users to set custom filters and parameters based on specific needs, such
and more.
Users can request or view the output by interacting with the dashboard,
which will present the data through visual aids like heatmaps for player locations.
This application would take inputs like team names, game sides (Terrorist or Counter
and specific map coordinates. Users could easily select these parameters and instant
fostering strategic understanding.
The application would employ a combination of Python web frameworks such as Django o
and JavaScript libraries like D3.js or Plotly for data visualization on the frontend
By incorporating such interactive visualization tools, we can offer to the non-techn
demographic of our stakeholders, allowing them to use the strategic insights that da
'''
```

Out[174]:

```
'\nProblem 3\n\n3. (No Coding) Most of the time, our stakeholders (in
this case, the CS:GO\ncoaching staff) aren't tech-savvy enough to run
code themselves. Propose a\nsolution to your product manager that:\na.
could allow our coaching staff to request or acquire the output themse
lves\nb. takes less than 1 weeks worth of work to implement\n\n\nAnswe
r: To empower the coaching staff to access and interpret strategic ins
ights without\nneeding to run the code themselves, we suggest developi
ng an intuitive, user-friendly web application.\nThis web dashboard, e
quipped with comprehensive data visualization tools,\nwill allow users
to set custom filters and parameters based on specific needs, such as
team, side, coordinates,\nand more.\nUsers can request or view the out
put by interacting with the dashboard,\nwhich will present the data th
rough visual aids like heatmaps for player locations.\nThis applicatio
n would take inputs like team names, game sides (Terrorist or Counter-
Terrorist),\nand specific map coordinates. Users could easily select t
hese parameters and instantly visualize the data,\nfostering strategic
understanding.\nThe application would employ a combination of Python w
eb frameworks such as Django or Flask for the backend,\nand JavaScript
libraries like D3.js or Plotly for data visualization on the fronten
d.\nBy incorporating such interactive visualization tools, we can offe
r to the non-technical \ndemographic of our stakeholders, allowing the
m to use the strategic insights that data provides.\n'
```

In [ ]: