```
import pandas as pd

# Load the dataset df =
pd.read_csv('flights.csv')
print(df)
```

```
            lon_departure  lat_departure  lon_arrival  lat_arrival
     0              61.838         55.509       38.510       55.681
     1              61.838         55.509       49.464       56.010
     2              61.838         55.509       83.084       55.021
     3              38.510         55.681       61.838       55.509
     4              38.510         55.681       20.987       55.483 ...              ...
                    ...          ...          ...
     57854           6.467         46.063        0.391       52.475
     57855           0.349         51.246        6.467       46.063
     57856           7.544         46.365        0.391       52.475
     57857           0.391         52.475        6.467       46.063
     57858           0.391         52.475        7.544       46.365

     [57859 rows x 4 columns]
```

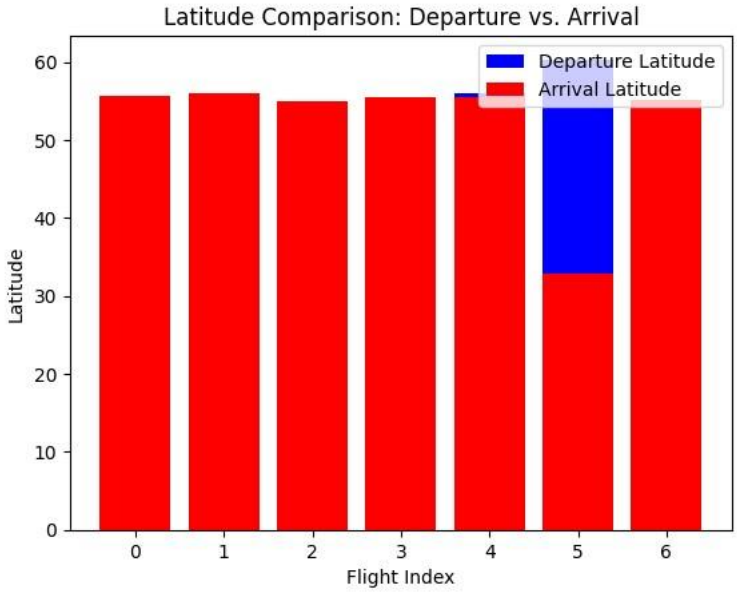
```
import pandas as pd

# Sample data
data = {
    'lon_departure': [61.838, 61.838, 61.838, 38.51, 38.51],
    'lat_departure': [55.509, 55.509, 55.509, 55.681, 55.681],
    'lon_arrival': [38.51, 49.464, 83.084, 61.838, 20.987],
    'lat_arrival': [55.681, 56.01, 55.021, 55.509, 55.483]
}

# Create DataFrame df =
pd.DataFrame(data)

# Print DataFrame
print(df)
```

```
        lon_departure  lat_departure  lon_arrival  lat_arrival
     0         61.838         55.509       38.510       55.681
     1         61.838         55.509       49.464       56.010
     2         61.838         55.509       83.084       55.021
     3         38.510         55.681       61.838       55.509
     4         38.510         55.681       20.987       55.483
```

```
import random

# Function to generate random latitude and longitude within a range def
generate_lat_lon_range(min_lat, max_lat, min_lon, max_lon):     return
round(random.uniform(min_lat, max_lat), 3), round(random.uniform(min_lon, max_lon), 3)

# Sample departure points
departure_points = [
    {"lon_departure": 61.838, "lat_departure": 55.509},
{"lon_departure": 38.51, "lat_departure": 55.681},
    {"lon_departure": 50.077, "lat_departure": 40.779},
    {"lon_departure": 20.987, "lat_departure": 55.483},
{"lon_departure": 49.464, "lat_departure": 56.01},
    {"lon_departure": 30.437, "lat_departure": 60.333},
    {"lon_departure": 12.31, "lat_departure": 48.589}
]

# Generate range of latitude and longitude for arrival points
arrival_points = [] for departure_point in departure_points:
    arrival_point = {}     arrival_point["lat_arrival"], arrival_point["lon_arrival"] =
generate_lat_lon_range(         departure_point["lat_departure"] - 10,
departure_point["lat_departure"] + 10,         departure_point["lon_departure"] - 10,
departure_point["lon_departure"] + 10
    )
arrival_points.append(arrival_point)

print("Arrival points with latitude and longitude range:")
print(arrival_points)
```

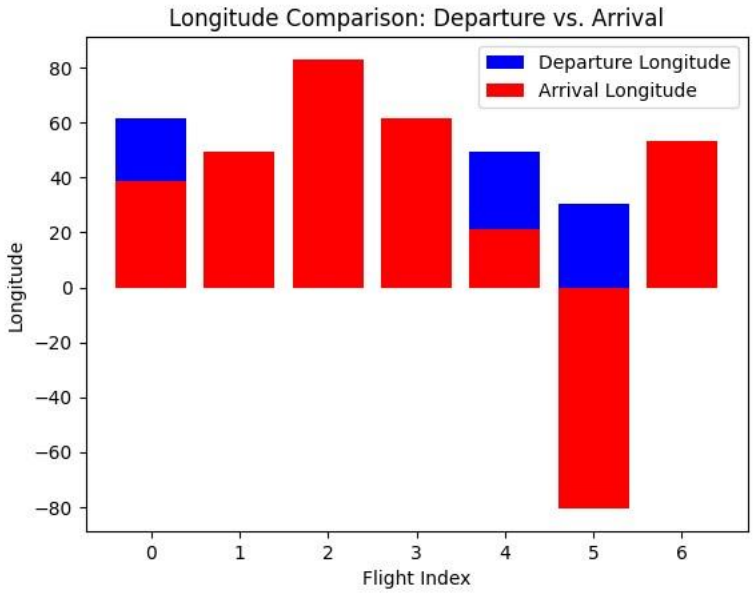
```
     Arrival points with latitude and longitude range:
```

```
import
     [{'lat_arrival': 54.866, 'lon_arrival': 54.562}, {'lat_arrival': 63.704, 'lon_arrival': 30.751}, {'lat_arrival': 36.949,
     'lon_arriv  matplotlib.pyplot as plt

# Sample departure and arrival points
departure_points = [
    {"lon_departure": 61.838, "lat_departure": 55.509},
{"lon_departure": 38.51, "lat_departure": 55.681},
    {"lon_departure": 50.077, "lat_departure": 40.779},
    {"lon_departure": 20.987, "lat_departure": 55.483},
{"lon_departure": 49.464, "lat_departure": 56.01},
    {"lon_departure": 30.437, "lat_departure": 60.333},
    {"lon_departure": 12.31, "lat_departure": 48.589}
]

arrival_points = [
    {"lon_arrival": 38.51, "lat_arrival": 55.681},
    {"lon_arrival": 49.464, "lat_arrival": 56.01},
    {"lon_arrival": 83.084, "lat_arrival": 55.021},
    {"lon_arrival": 61.838, "lat_arrival": 55.509},
    {"lon_arrival": 20.987, "lat_arrival": 55.483},
    {"lon_arrival": -80.539, "lat_arrival": 32.795},
    {"lon_arrival": 53.336, "lat_arrival": 55.066}
]

# Extract latitude values departure_latitudes = [point["lat_departure"] for
point in departure_points] arrival_latitudes = [point["lat_arrival"] for
point in arrival_points]

# Plotting plt.bar(range(len(departure_latitudes)), departure_latitudes, color='blue', label='Departure
Latitude') plt.bar(range(len(arrival_latitudes)), arrival_latitudes, color='red', label='Arrival
Latitude') plt.xlabel('Flight Index') plt.ylabel('Latitude') plt.title('Latitude Comparison: Departure
vs. Arrival') plt.legend() plt.show()
```



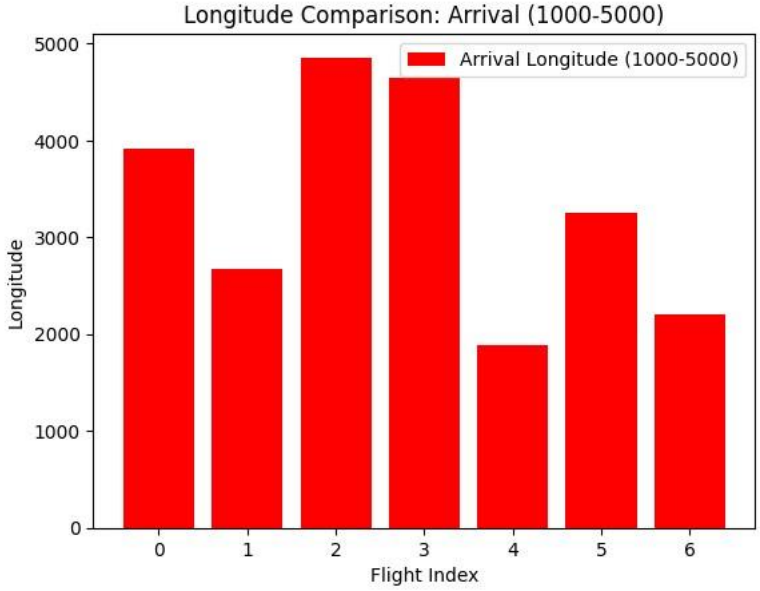

```
       matplotlib.pyplot as plt

# Sample departure and arrival points
departure_points = [
    {"lon_departure": 61.838, "lat_departure": 55.509},
{"lon_departure": 38.51, "lat_departure": 55.681},
    {"lon_departure": 50.077, "lat_departure": 40.779},
    {"lon_departure": 20.987, "lat_departure": 55.483},
{"lon_departure": 49.464, "lat_departure": 56.01},
    {"lon_departure": 30.437, "lat_departure": 60.333},
    {"lon_departure": 12.31, "lat_departure": 48.589}
]

arrival_points = [
    {"lon_arrival": 38.51, "lat_arrival": 55.681},
    {"lon_arrival": 49.464, "lat_arrival": 56.01},
    {"lon_arrival": 83.084, "lat_arrival": 55.021},
    {"lon_arrival": 61.838, "lat_arrival": 55.509},
    {"lon_arrival": 20.987, "lat_arrival": 55.483},
    {"lon_arrival": -80.539, "lat_arrival": 32.795},
    {"lon_arrival": 53.336, "lat_arrival": 55.066}
```

```
import
]

# Extract longitude values departure_longitudes = [point["lon_departure"] for
point in departure_points] arrival_longitudes = [point["lon_arrival"] for
point in arrival_points]

# Plotting plt.bar(range(len(departure_longitudes)), departure_longitudes, color='blue', label='Departure
Longitude') plt.bar(range(len(arrival_longitudes)), arrival_longitudes, color='red', label='Arrival
Longitude') plt.xlabel('Flight Index') plt.ylabel('Longitude') plt.title('Longitude Comparison: Departure
vs. Arrival') plt.legend() plt.show()
```



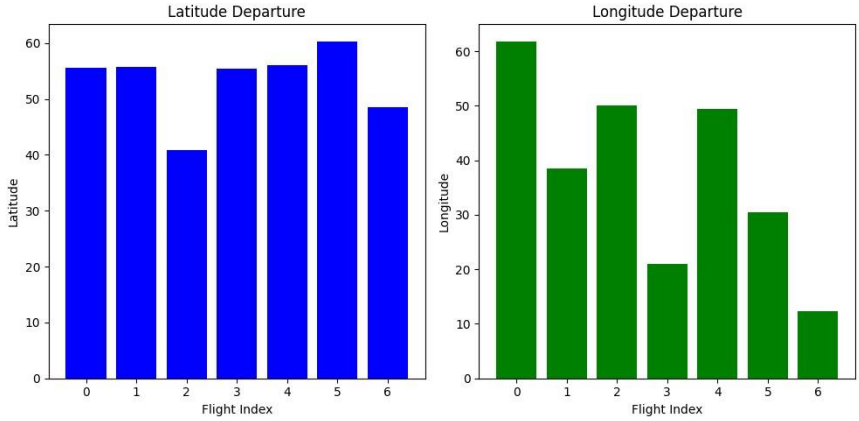

```
random

# Function to generate random longitude arrival between 1000 and 5000
def generate_lon_arrival():     return round(random.uniform(1000,
5000), 3)

# Sample departure and arrival points
departure_points = [
    {"lon_departure": 61.838, "lat_departure": 55.509},
{"lon_departure": 38.51, "lat_departure": 55.681},
    {"lon_departure": 50.077, "lat_departure": 40.779},
    {"lon_departure": 20.987, "lat_departure": 55.483},
{"lon_departure": 49.464, "lat_departure": 56.01},
    {"lon_departure": 30.437, "lat_departure": 60.333},
    {"lon_departure": 12.31, "lat_departure": 48.589}
]

# Generate arrival points with longitude between 1000 and 5000
arrival_points = [] for _ in range(len(departure_points)):
    arrival_point = {}     arrival_point["lon_arrival"] =
generate_lon_arrival()
arrival_points.append(arrival_point)

# Extract longitude values arrival_longitudes = [point["lon_arrival"]
for point in arrival_points]

# Plotting plt.bar(range(len(arrival_longitudes)), arrival_longitudes, color='red', label='Arrival Longitude
(1000-5000)') plt.xlabel('Flight Index') plt.ylabel('Longitude') plt.title('Longitude Comparison: Arrival
(1000-5000)') plt.legend() plt.show()
```

```
import
```




```
random

# Function to generate random latitude and longitude within a range def
generate_lat_lon_range(min_lat, max_lat, min_lon, max_lon):     return
round(random.uniform(min_lat, max_lat), 3), round(random.uniform(min_lon, max_lon), 3)

# Sample departure points
departure_points = [
    {"lon_departure": 61.838, "lat_departure": 55.509},
{"lon_departure": 38.51, "lat_departure": 55.681},
    {"lon_departure": 50.077, "lat_departure": 40.779},
    {"lon_departure": 20.987, "lat_departure": 55.483},
{"lon_departure": 49.464, "lat_departure": 56.01},
    {"lon_departure": 30.437, "lat_departure": 60.333},
    {"lon_departure": 12.31, "lat_departure": 48.589}
]

# Generate range of latitude and longitude for arrival points
arrival_points = [] for departure_point in departure_points:
    arrival_point = {}     arrival_point["lat_arrival"], arrival_point["lon_arrival"] =
generate_lat_lon_range(         departure_point["lat_departure"] - 10,
departure_point["lat_departure"] + 10,         departure_point["lon_departure"] - 10,
departure_point["lon_departure"] + 10
    )
arrival_points.append(arrival_point)

print("Arrival points with latitude and longitude range:")
print(arrival_points)


     Arrival points with latitude and longitude range:
     [{'lat_arrival': 65.055, 'lon_arrival': 62.282}, {'lat_arrival': 49.362, 'lon_arrival': 36.49}, {'lat_arrival': 50.315, 'lon_arriva


import matplotlib.pyplot as plt

# Sample departure points
departure_points = [
    {"lon_departure": 61.838, "lat_departure": 55.509},
{"lon_departure": 38.51, "lat_departure": 55.681},
    {"lon_departure": 50.077, "lat_departure": 40.779},
    {"lon_departure": 20.987, "lat_departure": 55.483},
{"lon_departure": 49.464, "lat_departure": 56.01},
    {"lon_departure": 30.437, "lat_departure": 60.333},
    {"lon_departure": 12.31, "lat_departure": 48.589}
]

# Extract latitude and longitude values departure_latitudes =
[point["lat_departure"] for point in departure_points] departure_longitudes =
[point["lon_departure"] for point in departure_points]

# Plotting
plt.figure(figsize=(10, 5))
```

```
import
plt.subplot(1, 2, 1) plt.bar(range(len(departure_latitudes)),
departure_latitudes, color='blue') plt.xlabel('Flight Index')
plt.ylabel('Latitude') plt.title('Latitude Departure')

plt.subplot(1, 2, 2) plt.bar(range(len(departure_longitudes)),
departure_longitudes, color='green') plt.xlabel('Flight Index')
plt.ylabel('Longitude') plt.title('Longitude Departure')

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



```
# Sample departure points departure_points = [
    {"lon_departure": 61.838, "lat_departure": 1555.509},
{"lon_departure": 38.51, "lat_departure": 1555.681},
    {"lon_departure": 50.077, "lat_departure": 1040.779},
    {"lon_departure": 20.987, "lat_departure": 1555.483},
{"lon_departure": 49.464, "lat_departure": 1556.01},
    {"lon_departure": 30.437, "lat_departure": 1600.333},
    {"lon_departure": 12.31, "lat_departure": 1048.589}
]

# Filter departure points within the range 1000-2000 filtered_departure_points = [point for point in
departure_points if 1000 <= point["lat_departure"] <= 2000]

# Calculate the range of latitude departure within the filtered points
if filtered_departure_points:
    min_lat_departure = min(point["lat_departure"] for point in filtered_departure_points)
max_lat_departure = max(point["lat_departure"] for point in filtered_departure_points)
print("Latitude Departure Range (1000-2000):", min_lat_departure, "-", max_lat_departure)
else:     print("No departure points found within the specified latitude range.")
```

```
Latitude Departure Range (1000-2000): 1040.779 - 1600.333
```

```
# Sample departure points
departure_points = [
    {"lon_departure": 618.838, "lat_departure": 55.509},
    {"lon_departure": 38.51, "lat_departure": 55.681},
    {"lon_departure": 1500.077, "lat_departure": 40.779},
    {"lon_departure": 20.987, "lat_departure": 55.483},
{"lon_departure": 49.464, "lat_departure": 56.01},
    {"lon_departure": 30.437, "lat_departure": 60.333},
{"lon_departure": 812.31, "lat_departure": 48.589}
]

# Filter departure points within the range 800-1800 filtered_departure_points = [point for point in
departure_points if 800 <= point["lon_departure"] <= 1800]

# Calculate the range of longitude departure within the filtered points
if filtered_departure_points:
    min_lon_departure = min(point["lon_departure"] for point in filtered_departure_points)
max_lon_departure = max(point["lon_departure"] for point in filtered_departure_points)
print("Longitude Departure Range (800-1800):", min_lon_departure, "-", max_lon_departure)
else:     print("No departure points found within the specified longitude range.")
```

```
Longitude Departure Range (800-1800): 812.31 - 1500.077
```