Flight Delay and Airport Analysis Report

Week-5

1. Monthly Average Departure Delay

Graph Type: Line Plot
Columns Used: Date, DepDelay

Description:

- Extracted the month from the Date column.
- Grouped the dataset by month and calculated the average departure delay.
- Plotted a line graph showing how the average departure delay varies across the months.

Purpose:

- To identify seasonal trends in departure delays.

Inference:

- Certain months may show higher delays due to weather, holidays, or peak travel seasons.
- Airlines and airports can use this insight to optimize scheduling and resource allocation.

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2. Average Departure Delay by Hour of the Day

Graph Type: Line Plot
Columns Used: DepTime, DepDelay

Description:

- Extracted the departure hour from the DepTime column.
- Grouped the data by hour and calculated the average departure delay for each hour.
- Plotted a line graph showing the trend of delays across different hours of the day.

Purpose:

- To analyze how delays vary by time of day.

Inference:

- Peak traffic hours might have higher delays.
- Off-peak times generally have lower delays.
- Helps in planning optimal departure slots to reduce delays.

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3. Delay Cause Contribution by Origin Airport

Graph Type: Stacked Bar Chart
Columns Used: Org_Airport, WeatherDelay, CarrierDelay, NASDelay, SecurityDelay, LateAircraftDelay

Description:

- Calculated the mean contribution of different delay causes for each origin airport.
- Created a stacked bar chart to visualize how each type of delay contributes to the total delay at each airport.

Purpose:

- To identify which airports have more significant issues with specific types of delays.

Inference:

- Airports with a high contribution from weather delays may need better weather contingency planning.
- Carrier, NAS, or late aircraft delays indicate operational or scheduling inefficiencies.

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4. Worst Airlines by Average Departure Delay

Graph Type: Horizontal Bar Plot
Columns Used: Airline, DepDelay

Description:

- Grouped the data by airline and calculated the mean departure delay.
- Sorted airlines by average delay and plotted a horizontal bar chart.

Purpose:

- To identify airlines with the worst performance in terms of departure delays.

Inference:

- Airlines with consistently higher delays may need operational improvements.
- Passengers can make informed choices based on historical delay trends.

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5. Airport Visualization (Randomized Coordinates for Demo)

Graph Type: Interactive Map (Plotly)
Columns Used: Org_Airport

Description:

- Assigned random coordinates for visualization purposes.
- Computed the number of flights originating from each airport.
- Plotted airports on a US map with marker size proportional to the number of flights.

Purpose:

- To visualize airport traffic distribution.

Inference:

- Larger markers indicate busier airports.
- Helps in understanding which airports handle the most traffic.

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6. Average Departure Delay by Origin Airport

Graph Type: Horizontal Bar Plot
Columns Used: Org_Airport, DepDelay

Description:

- Calculated the mean departure delay for each origin airport.
- Plotted a horizontal bar chart showing average delay per airport.

Purpose:

- To identify airports with higher average departure delays.

Inference:

- Airports with consistently high delays may need operational improvements.

- Useful for airline and airport performance evaluation.

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7. Heatmap of Average Departure Delay by Route

Graph Type: Heatmap
Columns Used: Org_Airport, Dest_Airport, DepDelay

Description:

- Created a pivot table of average departure delay for each origin-destination pair.
- Plotted a heatmap showing delays from each origin to each destination.

Purpose:

- To identify routes with higher delays.

Inference:

- Helps airlines optimize scheduling on problematic routes.
- Shows which origin-destination pairs contribute most to delay patterns.

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8. Top 10 Origin-Destination Flight Routes

Graph Type: Horizontal Bar Plot
Columns Used: Org_Airport, Dest_Airport

Description:

- Counted the number of flights for each origin-destination pair.
- Sorted and selected the top 10 routes by flight count.
- Plotted a horizontal bar chart showing the busiest routes.

Purpose:

- To identify the most frequently flown routes.

Inference:

- Indicates high-demand routes that may need more resources or scheduling attention.
- Airlines can prioritize operations and monitor delays on these routes closely.

Summary:

- These graphs together provide insights into **time-based trends**, **airline performance**, **airport efficiency**, **route delays**, and **traffic patterns**.
- Airlines and airports can use this analysis for operational planning, optimizing schedules, and improving passenger experience.