Flight Delay Analysis Report

Week-4

1. Average Departure Delay by Hour and Airport (Heatmap)

Description:
This heatmap shows the **average departure delay** for each combination of **hour of the day** and **origin airport**. Each cell's color intensity represents the delay magnitude — darker colors indicate longer average delays.
The X-axis represents the hour of departure (0–23), while the Y-axis lists different origin airports.

Inference:

- Flights departing during **late evenings (18:00–23:00)** tend to experience **longer delays** compared to early morning flights.
- Certain airports consistently show **higher delays**, indicating possible congestion or operational inefficiencies.
- This graph helps identify **peak delay hours** and **underperforming airports**, which can be targeted for schedule optimization.

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2. Delay Type Distribution by Airline (Stacked Bar Chart)

Description:
This stacked bar chart visualizes how different **types of delays** contribute to each airline's total delay time. Delay categories include Carrier, Weather, NAS (Air Traffic), Security, and Late Aircraft delays. Each airline is represented on the X-axis, and delay time on the Y-axis, with color-coded bars indicating each delay type.

Inference:

- Some airlines have **higher Carrier Delays**, suggesting internal operational or scheduling issues.
- **Late Aircraft Delays** are significant for multiple airlines, showing cascading effects from previous flights.
- **Weather and Security Delays** contribute minimally, implying they are less frequent but still impactful when they occur.
- This visualization enables performance comparison among airlines and highlights where efficiency improvements are needed.

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3. Total Delay vs. Time of Day (Line Graph)

Description:
This line graph shows the **total delay time aggregated across all flights** for each hour of the day. It captures how overall delays fluctuate throughout the day. The X-axis represents time (in hours), and the Y-axis shows total delay minutes.

Inference:

- Total delays are **lowest during early morning hours (0:00–6:00)** when air traffic is light.
- **Delays increase steadily** as the day progresses, peaking around **afternoon to evening (15:00–21:00)** due to cumulative scheduling impacts.
- Indicates the **importance of managing flight turnaround efficiency** during high-traffic periods.

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4. Correlation Between Different Delay Causes (Correlation Heatmap)

Description:
This heatmap displays the **correlation coefficients** between various delay causes such as Carrier, Weather, NAS, Security, and Late Aircraft delays. A correlation value close to +1 indicates a strong positive relationship, while a value near 0 suggests weak or no correlation.

Inference:

- Strong correlation between **Carrier Delay** and **Late Aircraft Delay** indicates that **previous flight delays directly influence subsequent flight schedules**.
- **Weather Delay** shows weak correlation with other delay types, confirming it acts independently and unpredictably.
- This helps airlines and airport authorities **identify interconnected delay patterns** to improve turnaround and scheduling strategies.

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5. Distribution of Total Delay by Airline (Boxplot)

Description:
This boxplot represents the **distribution and variability of total delay times** across different airlines. The central line of each box shows the median delay, the box height

represents the interquartile range (IQR), and points outside the whiskers indicate outliers.

Inference:

- Airlines with **narrow boxes** have more **consistent performance**, while those with **taller boxes or many outliers** experience greater delay variability.
- Outliers indicate occasional **extreme delays**, possibly due to exceptional circumstances like technical or weather issues.
- Helps identify **which airlines are most reliable** and which have high delay inconsistency that needs investigation.

Overall Insights:

- Flight delays show **strong temporal and airport-based patterns**, with evenings being most delay-prone.
- **Carrier and Late Aircraft delays** are the dominant and most correlated contributors.
- Airlines differ significantly in delay consistency, offering clear benchmarks for operational improvement.
- Data visualization helps in **pinpointing systemic inefficiencies**, supporting data-driven decision-making in flight scheduling and airport management.