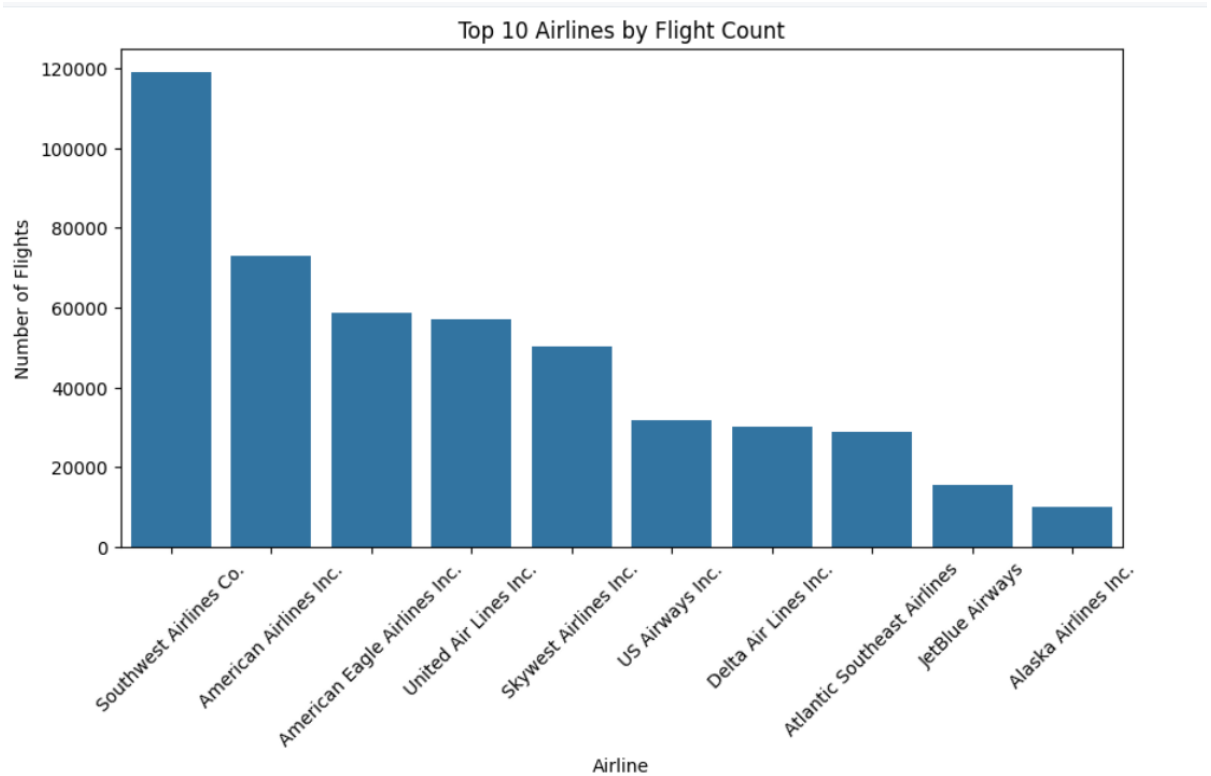# Week 3 Report

Univariate and Bivariate Visual Analysis

Week 3: Univariate and Bivariate Visual Analysis

- Top airlines, routes, and busiest months

- Flight distribution by day, time, and airport

- Plot bar charts, histograms, boxplots, and line plots
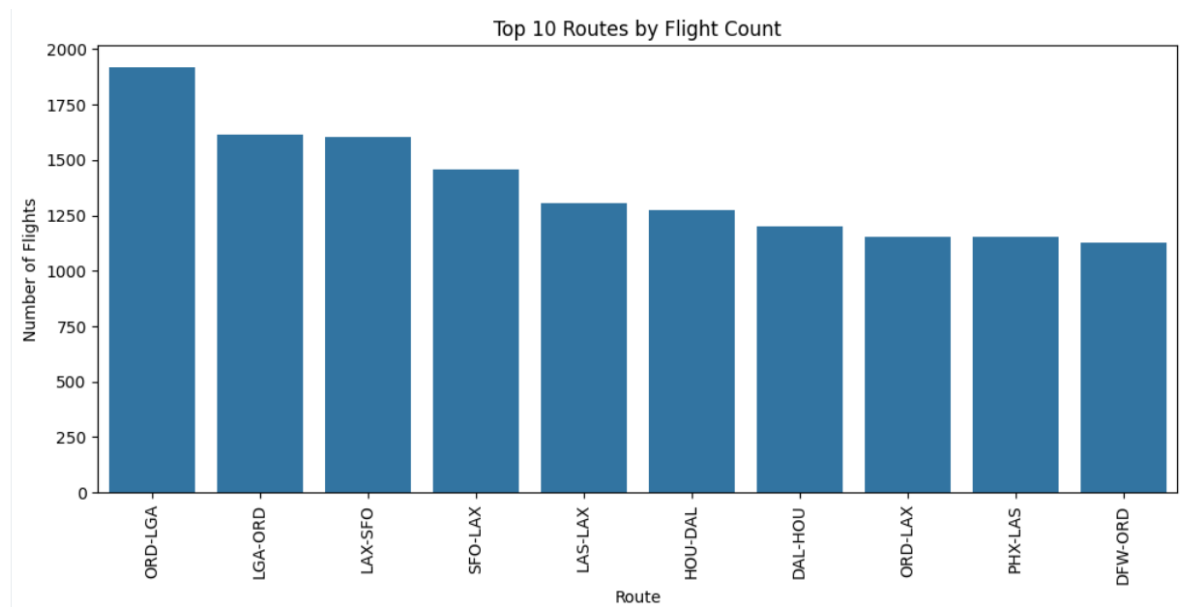
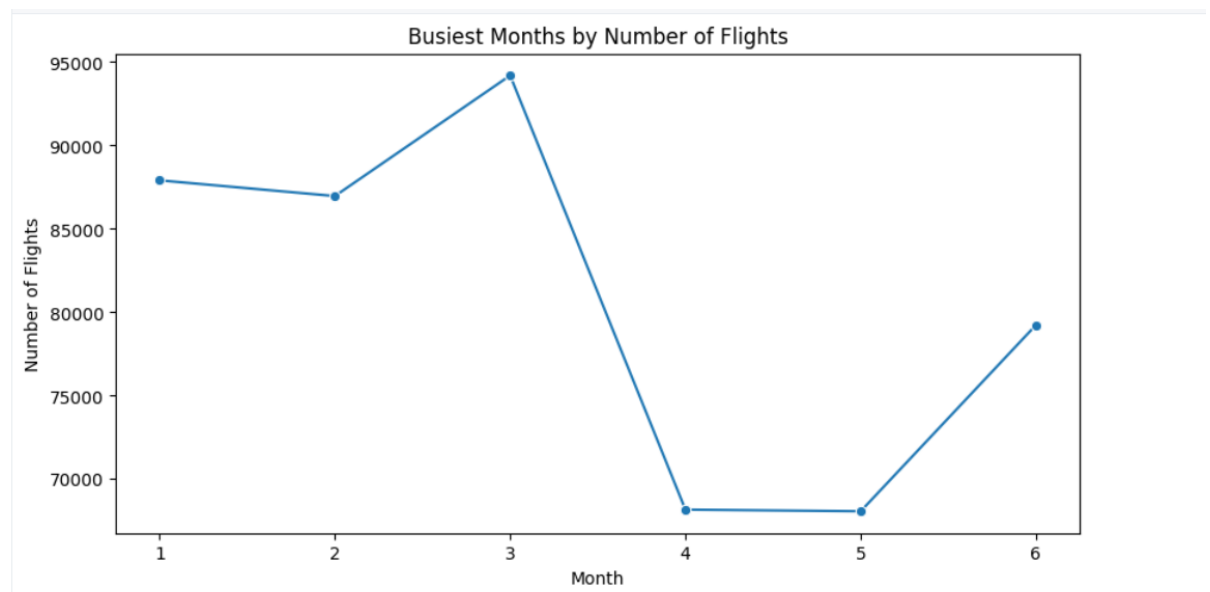**1. Top Airlines, Routes, and Busiest Months**

Key Insights:

- Top Airline:

Southwest Airlines Co. has the most flights (~120,000), much more than any other airline.

- Top Route:

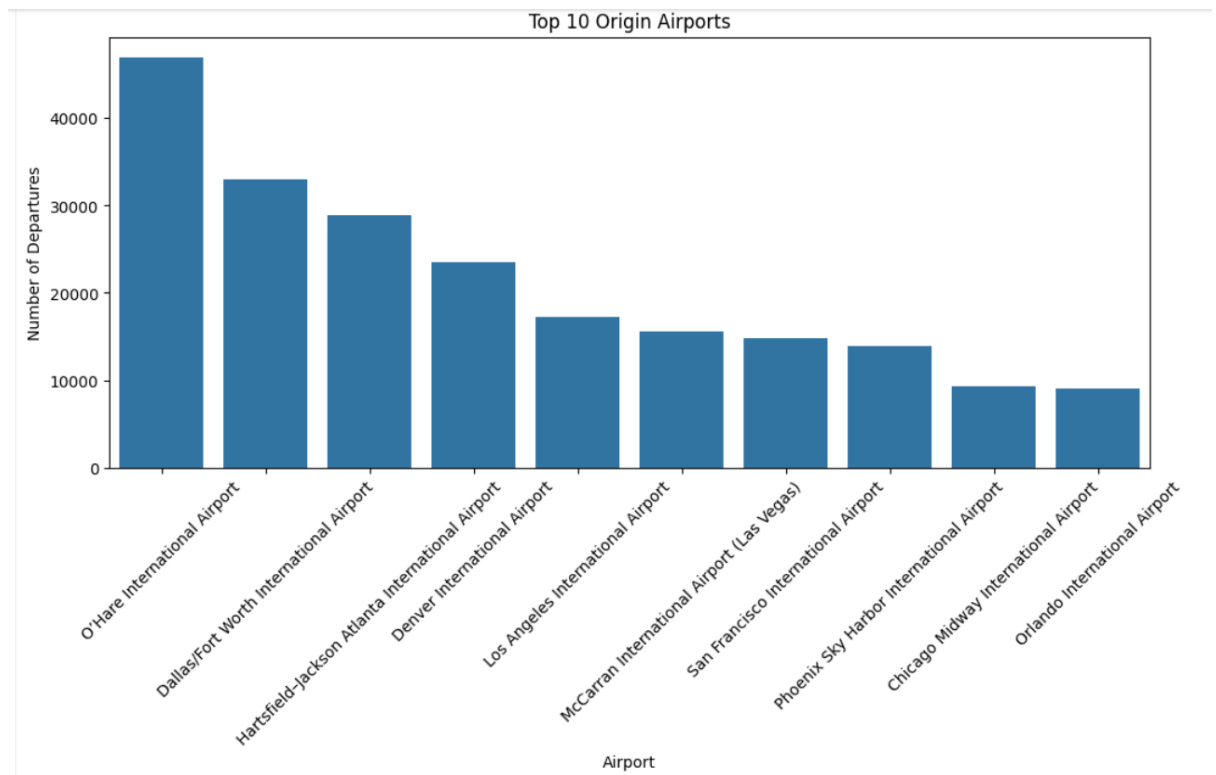Top 10 Routes by Flight Count

The busiest flight path is O'Hare (ORD) → LaGuardia (LGA).

- Busiest Month:

Busiest Months by Number of Flights

March (Month 3) has the most flights (around 94,500). Flight numbers drop sharply in April and May.

- Top Origin Airport:

Top 10 Origin Airports

O'Hare International Airport (ORD) has the highest number of departing flights.

- Pattern:
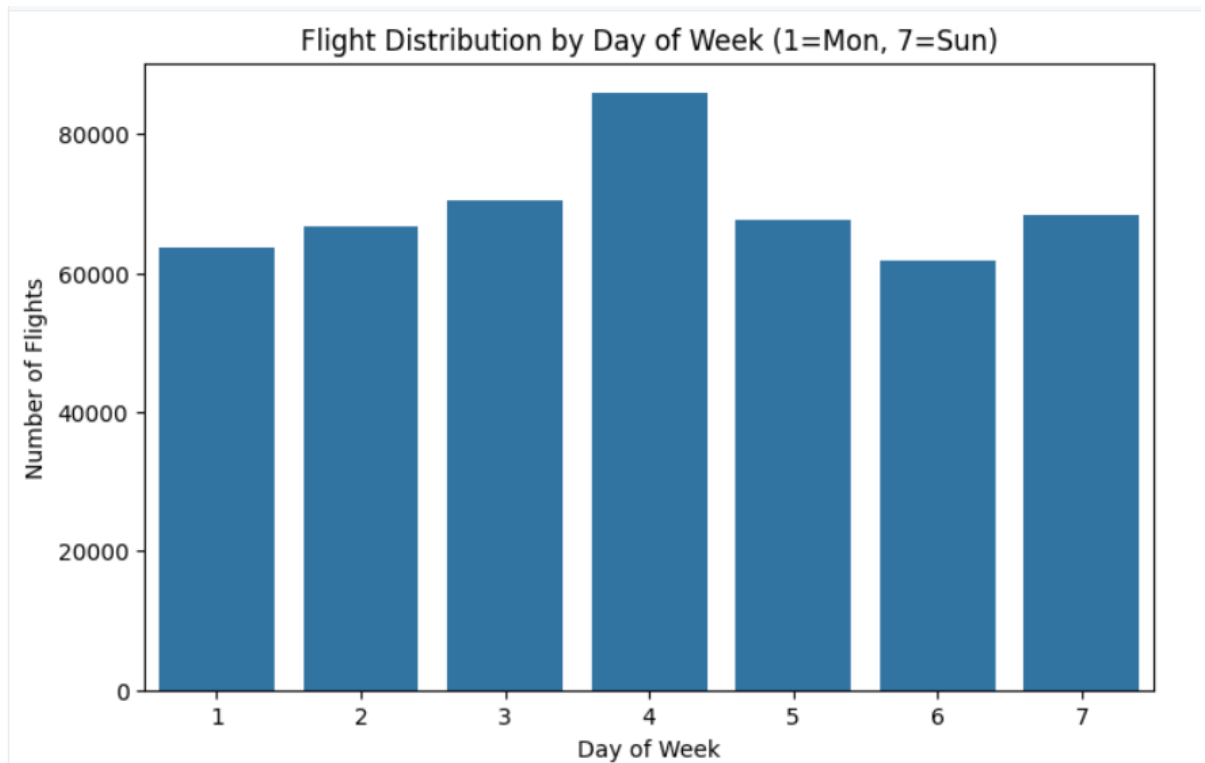 Air traffic is highest in early spring and focused around major city routes.

Possible Measures:

- Add more flights or larger aircraft on popular routes (like ORD–LGA).

- Plan for extra staff and airport operations during March.

- Use quieter months (April–May) for maintenance or training.

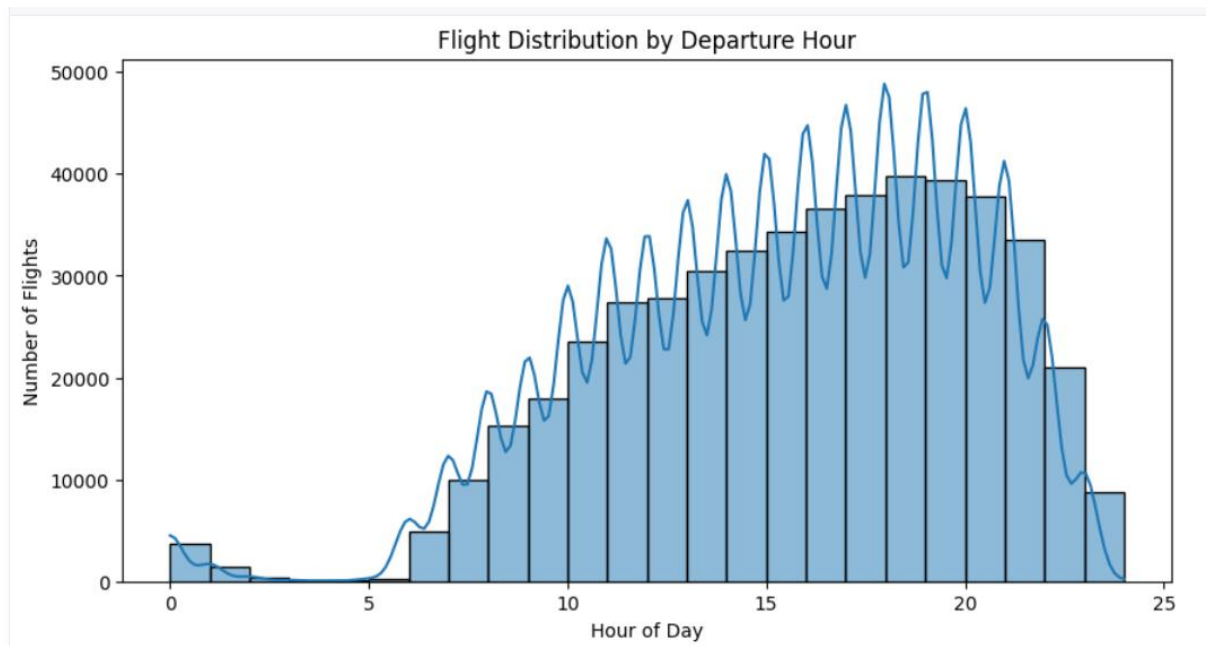**2. Flight Distribution by Day, Time, and Airport**
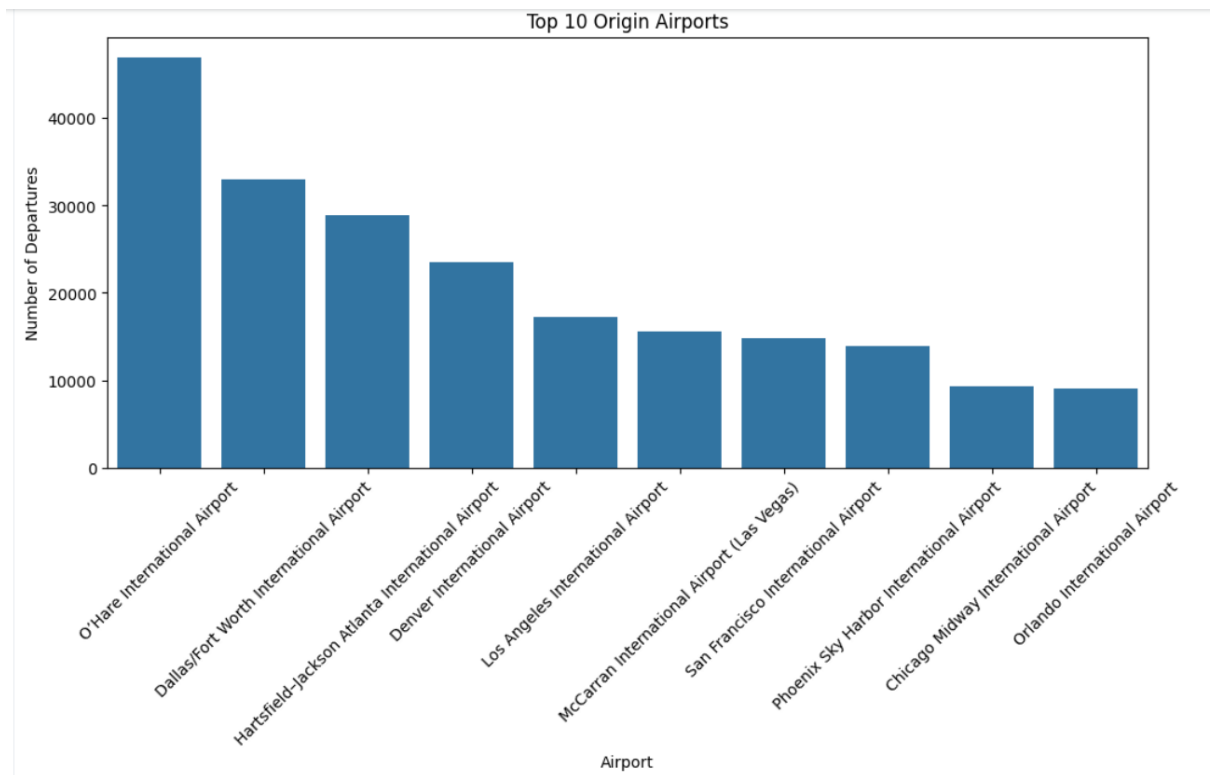
Key Insights:

- Busiest Day:

Thursday (Day 4) has the highest number of flights.

- Busiest Time:

Flights mostly depart between late afternoon and early evening, peaking around 7 PM (19th hour).

- Busiest Origin Airport:

O'Hare (ORD) again leads with the most departures.

- Pattern:
  Weekdays, especially mid-to-late week, are busier than weekends.

Possible Measures:

- Increase airport and ground crew capacity during Thursday evenings.

- Spread flight schedules to reduce evening congestion.

- Provide more passenger support and services during peak hours.

3. Delays and Performance

Key Insights:

Average Arrival Delay by Airline
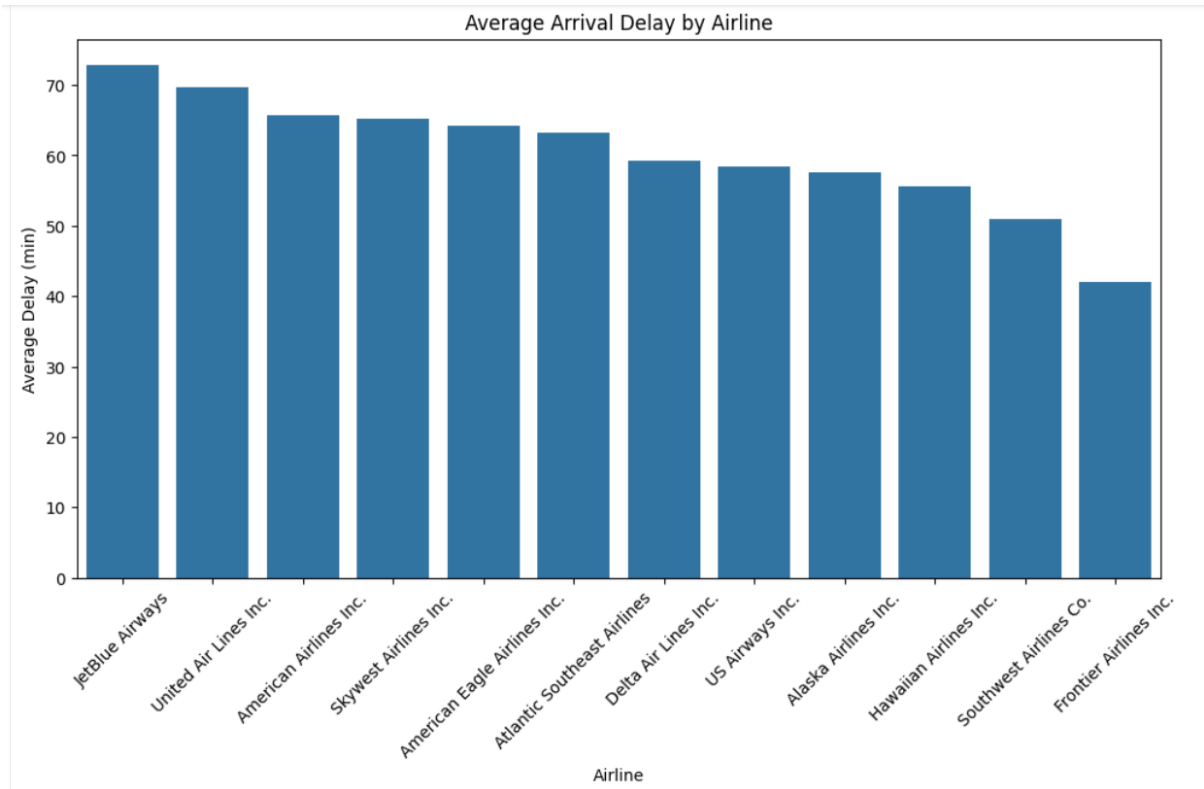
- Most Delayed Airline:
  JetBlue Airways – highest average arrival delay (over 70 minutes).

- Best Performer:
  Frontier Airlines Inc. – lowest average arrival delay (~42 minutes).

- Efficient Large Airline:
  Southwest Airlines manages the most flights but still has low delays.

- Delay Patterns:
  Average delays stay between 0–100 minutes, but some flights have extreme delays (up to 3,000 minutes).

Possible Measures:

- Airlines like JetBlue should review crew, maintenance, and turnaround processes.

- Reduce flight congestion by spreading departure times.

- Study efficient airlines (like Southwest) to apply their best practices.

4. Distance and Air Time

Key Insights:

Relationship between Distance and Air Time
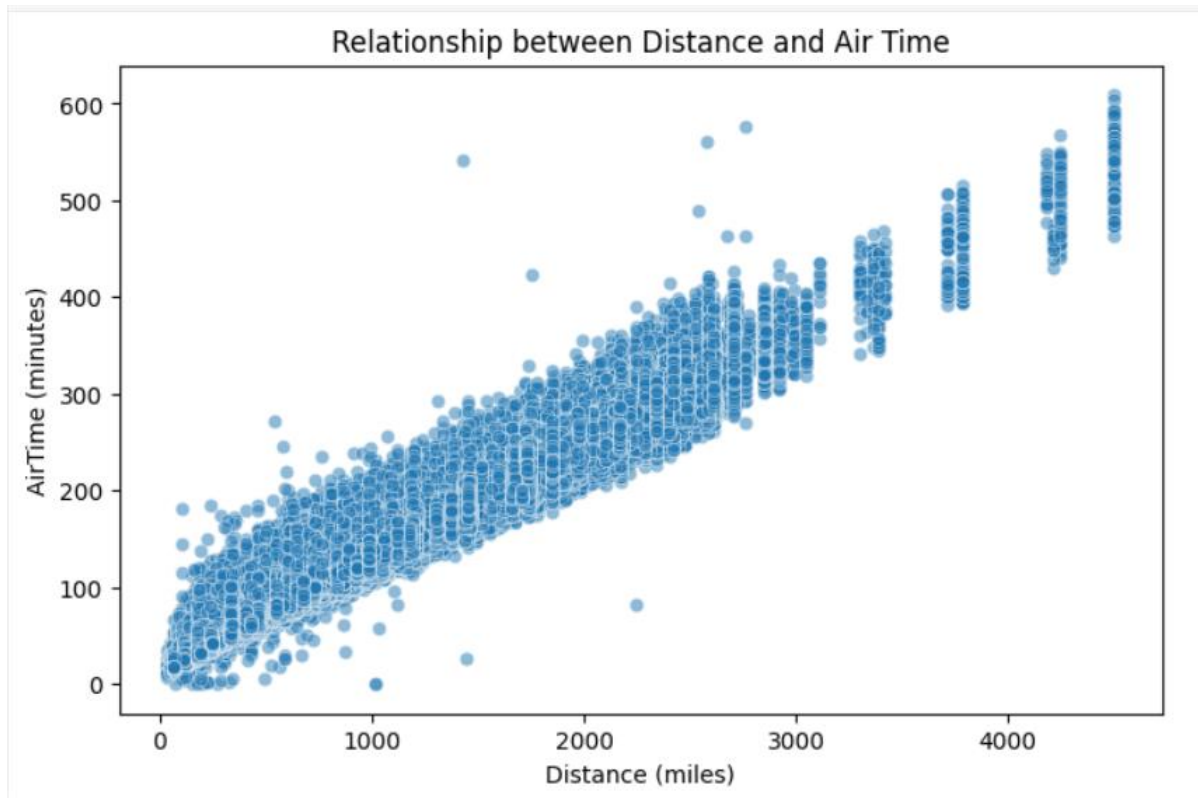
- Strong Relationship:
  The scatter plot shows a clear positive correlation — longer distances mean longer air times.

- Data Quality:
  The close pattern of points along a line shows reliable data with no major errors.

Possible Measures:

- Use this relationship to predict flight times more accurately.

- Check future data against this trend to catch possible data entry issues.

5. Market Share and Airport Activity

Key Insights:

Market Share of Top 8 Airlines
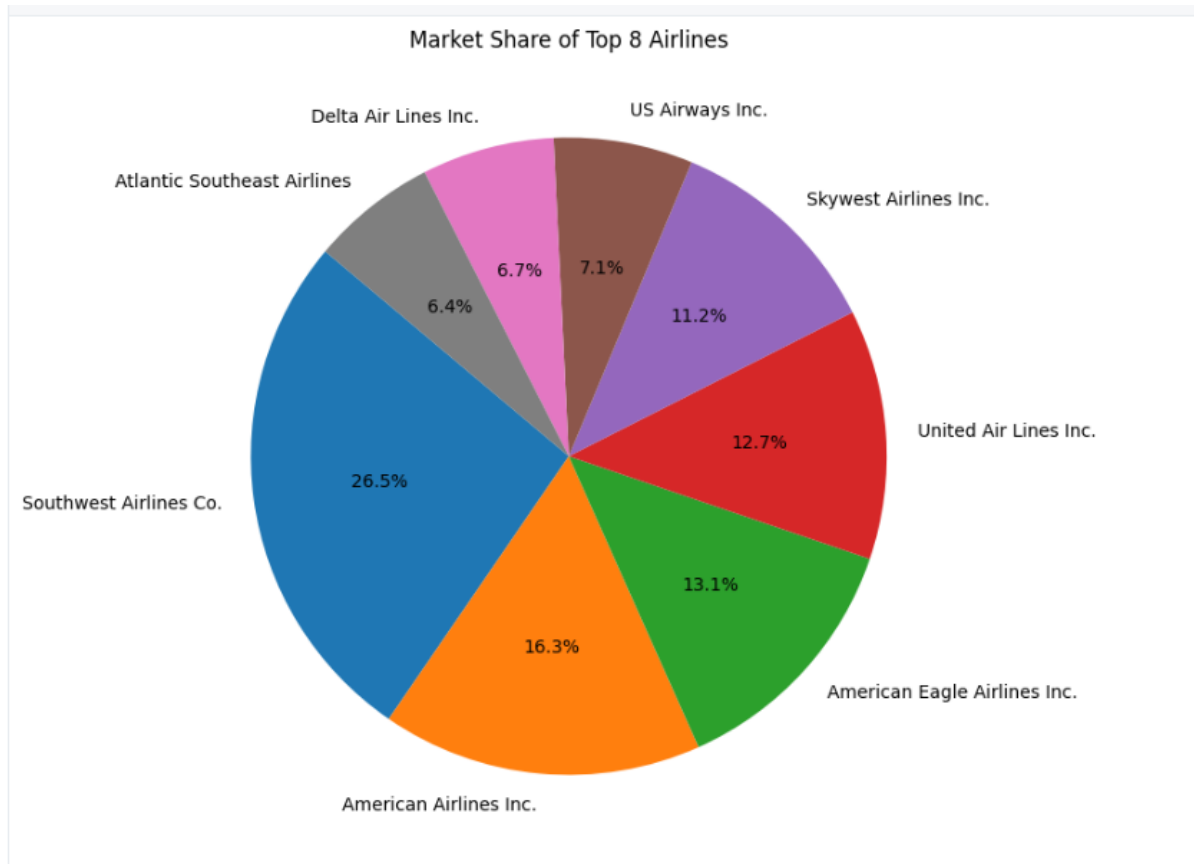
- Largest Market Share:
  Southwest Airlines holds about 26.5% of total flights.

- Second Place:
  American Airlines holds around 16.3%.

- Busiest Arrival Airport:
  O'Hare (ORD) again is the busiest destination airport.

- Distance Distribution:
  Most flights are short-haul (200–300 miles); a smaller group are medium-haul (1,500–2,000 miles).

- Flight Duration:
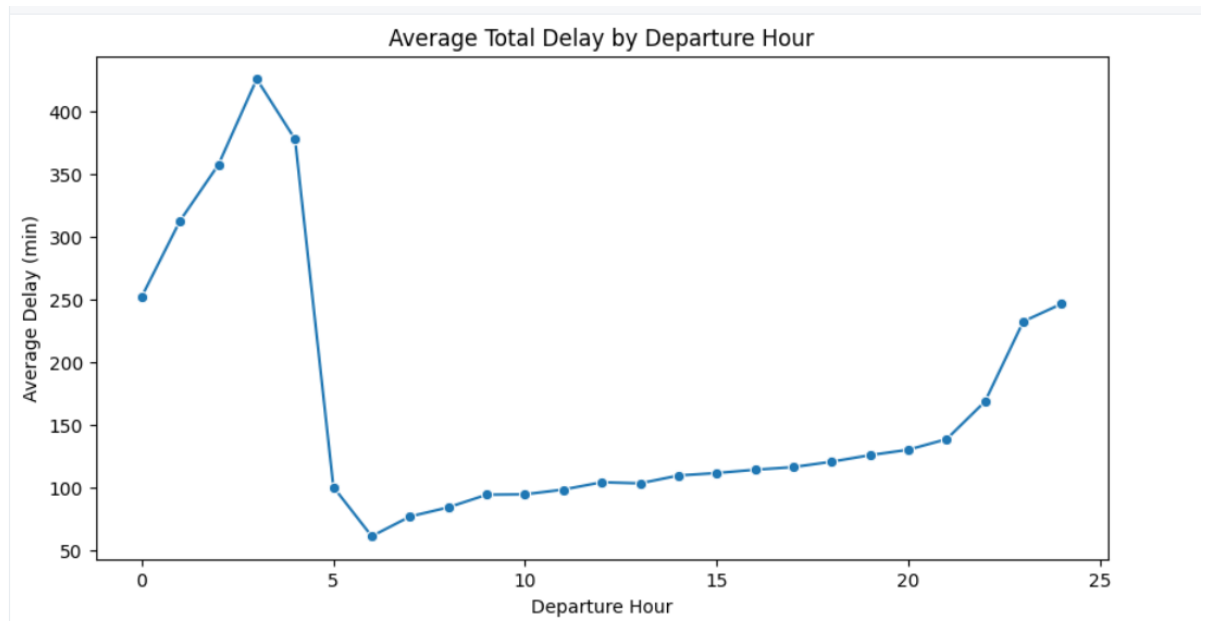 Short flights (50–100 minutes) are most common.

Possible Measures:

- Expand medium-haul routes to balance traffic.

- Improve infrastructure and scheduling at O'Hare.

- Smaller airlines could focus on niche or underserved routes.
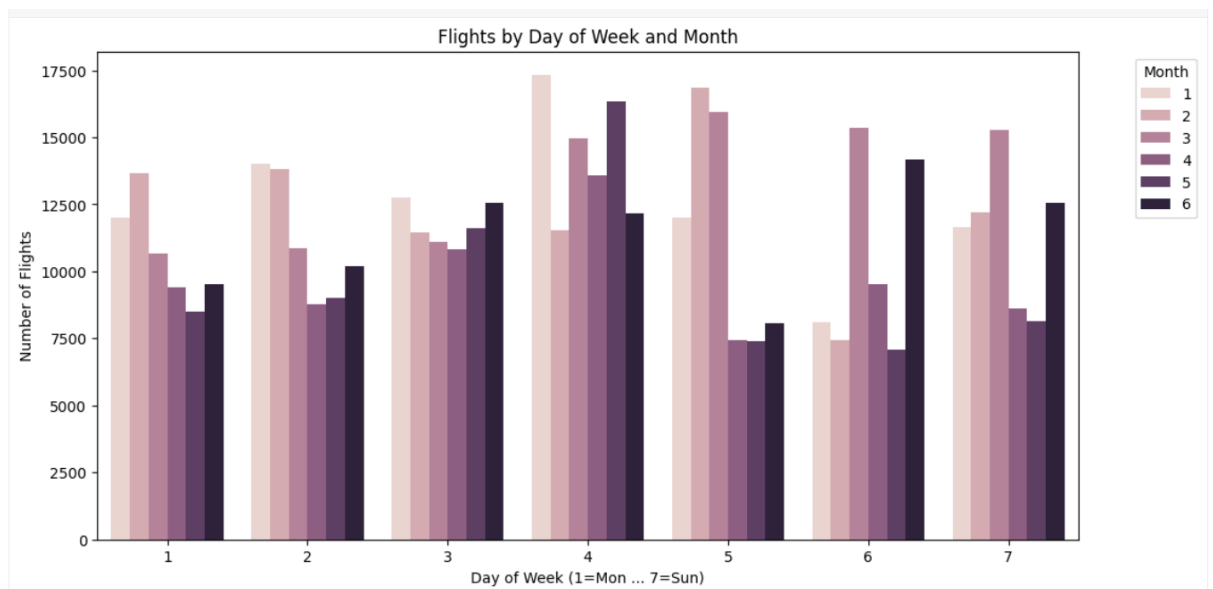
6. Delays and Flight Timing

Key Insights:

- Peak Delay Times:

Flights at 4 AM have the highest delays (~400 minutes).
Delays drop around 6 AM (60 minutes) and then slowly rise during the day.

- Volume Patterns:

- o March (Month 3) has the highest flight activity every week.

- o Fridays (Day 5) are generally busy across all months.

- o Thursdays (Day 4) show strong activity in April and May.

Possible Measures:

- Avoid scheduling many flights between 2–5 AM, when delays are longest.

- Spread flights evenly throughout the day.

- Increase air traffic control and ground support during busy periods (Thursdays, Fridays).

7. Flight Duration and Correlation

Key Insights:

Correlation Heatmap of Numerical Features
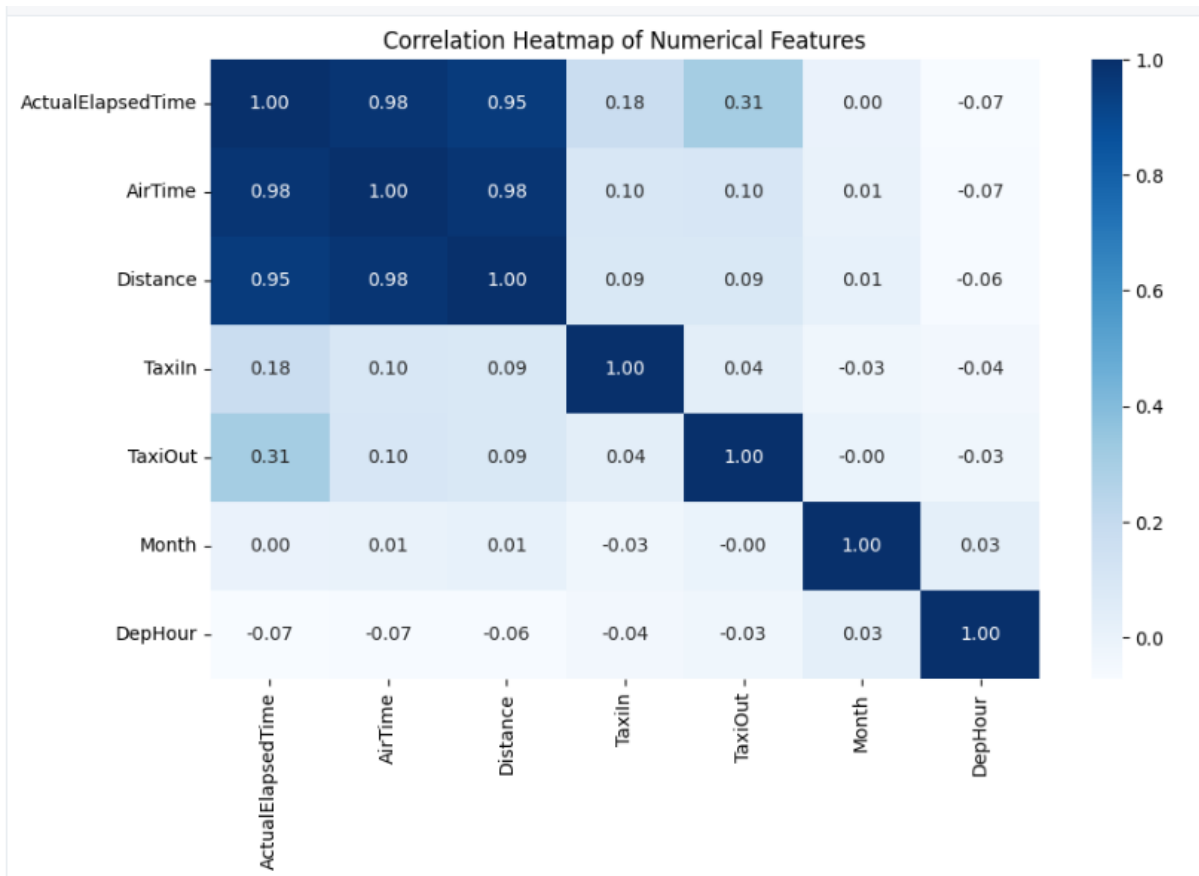
- Longest Average Duration:
  JetBlue Airways (~175 minutes).

- Shortest Average Duration:
  SkyWest Airlines Inc. (~100 minutes).

- Longest Routes:
  HNL–ATL (Honolulu–Atlanta) and ATL–HNL, both over 4,250 miles.

- Strong Correlation:
  Flight time depends mainly on distance (high correlation).

- Moderate Correlation:
 Small link between TaxiOut time and total duration (0.31).

- Weak Correlation:
  Month and departure hour don't affect flight time much.

Possible Measures:

- Use correlation data to forecast travel time and plan connections.

- Review taxiing processes to reduce ground time.

- Analyze long-haul flights (like Hawaii routes) for fuel and crew efficiency.

8. Flight Duration by Day of Week

Key Insights:
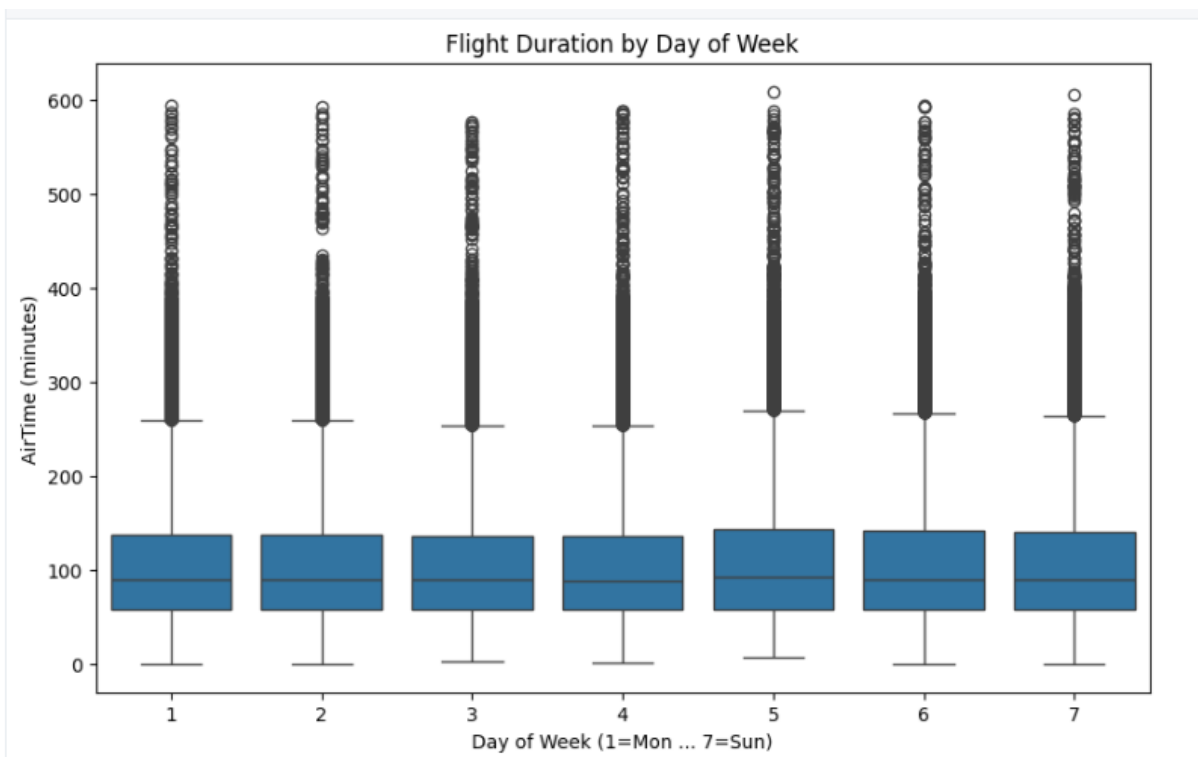
- Consistency:
  Flight durations are about the same every day (~100 minutes).

- No Major Changes:
  Median times and outliers are stable across all days, meaning day of week doesn't affect flight length.

Possible Measures:

- Keep uniform staffing and scheduling across all days — demand is steady.

- Use this stability for predictable crew rotations and maintenance planning.

9. Overall Summary

Key Takeaways:

- Thursdays, evenings, and March are the busiest times for flights.

- Southwest Airlines leads in both flight count and efficiency.

- O'Hare (ORD) is the central hub for both departures and arrivals.

- Most flights are short-haul and consistent across days.

- Delays are time-dependent (especially early morning) but not day-specific.

- Flight data shows strong internal consistency between distance and air time.

Overall Recommendations:

- Adjust schedules to avoid early-morning congestion.

- Focus resources on busy routes, airports, and months.

- Adopt efficiency strategies from low-delay airlines.

- Continue monitoring patterns seasonally for better planning.