IE4163 Assignment 1: Factorial Experimental Design

John Bradley

September 12, 2024

1 Experiment Design

Atlanta's Hartsfield-Jackson airport is the busiest airport in the world by passenger volume and serves as Delta's main connecting hub. For this experiment, the relationship between three factors will be compared against the percentage of on-time flights: flight operation, airline, and season.

Flight operation, meaning an arrival or depature flight, are relatively even as there is a limited amount of space at the airport, and for every plane that arrives, typically another plane is leaving. This can compare possible issues that originate at the aiport or from an airport elsewhere.

Two airlines will be observed as part of this experiment. Delta is the primary operator at this airport, while Endeavor Air is Delta's regional operator. This will compare operational efficiencies between the two connected airlines and possible differences between larger and smaller planes.

Finally, sasons will be compared, as weather between these two categories of months will be different - hot weather months will see more storms while cold weather months will see snow and ice-related delays at airports served by Atlanta elsewhere in the north. The specific months chosen for each season will be January for Winter, April for Spring, July for Summer, and October for Fall.

On-time flight percentages are based on the cumulative number of flights recorded within a month. All data comes from the United States Department of Transportation Bureau of Transportation Statistics and will be using data from 2023. Percentages are used because average monthly operations between the two airlines aren't completely equal, with Delta operating approximately 15,000 flights monthly and Endeavor Air flies approximately 5,000 monthly.

2 Observation

	On-Time Flights (%)	Flight Operation	Airline	Season
Observation 1	81.71	Arrival	Delta	Winter
Observation 2	82.75	Arrival	Delta	Spring
Observation 3	78.81	Arrival	Delta	Summer
Observation 4	92.59	Arrival	Delta	Fall
Observation 5	81.72	Arrival	Endeavor	Winter
Observation 6	89.78	Arrival	Endeavor	Spring
Observation 7	86.73	Arrival	Endeavor	Summer
Observation 8	94.41	Arrival	Endeavor	Fall
Observation 9	74.04	Departure	Delta	Winter
Observation 10	76.64	Departure	Delta	Spring
Observation 11	69.22	Departure	Delta	Summer
Observation 12	90.14	Departure	Delta	Fall
Observation 13	83.56	Departure	Endeavor	Winter
Observation 14	91.43	Departure	Endeavor	Spring
Observation 15	83.67	Departure	Endeavor	Summer
Observation 16	94.14	Departure	Endeavor	Fall

Table 1: On-Time Flights

3 Analyzation and Interaction Effects

It stands out that flights originate in the fall, regardless of flight operation or airline, tend to be the most likely to be on-time, with the highest percentages. This is likely due to more calm and predictable weather in the fall, as sprint and summer storms cause the airport to halt flights, and unexpected snow-storms and holiday travel may inpact the fall.

Additionally, flights operated by Endeavor Air tend to perform well, with percentages that are 5 - 10% higher. This may be due to the sheer volume of flights that Delta performs, with a higher chance of delays, while Endeavor can better focus on the fewer flights that they operate.

For Delta flights, it seems like flight operation has an effect on if a flight is delayed. Delta flights originating from Atlanta have a tendency to be delayed while arrivals are less effected. I believe there is an interaction here because flights by Endeavor have a ¡ 5% affect on on-time flights, while for Delta, departures are ¿ 5%, except in the fall.

4 Conclusion

While there's not much that I personally can do to make improvements to the real world results of Delta and Endeavor Air's flight operations, this could indicate to Delta that the can make improvements by focusing on possible factors that affect on-time performance, specifically processes that cause flights that leave Atlanta to be delayed. The data I've collected does not look into specific reasons why flights are delayed, but it can narrow it down to delays caused by operations at Atlanta.