

DSC 465-910 — Course Project PD 2

Data Visualization – 2021 Spring

Submitted to:

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Executive Summary

The dataset has multi-year US domestic flight data from 2009 to 2018. We explored ~~all of them~~ the dataset and determined ~~to study the data in 2016~~ that 2016 was the ideal candidate for this project. In this submission, we included a flight destination density map, which shows that most flight destinations ~~come~~ are located from California, the ~~e~~East ~~e~~Coast, the Midwest, and ~~southern coastlines~~ Florida and the Gulf Coasts. We also employed two heatmaps to visualize flight delays by both days and months. We then performed exploratory and explanation explanatory analysis to demonstrate some of our ideas of ~~what the data now really looks like and how it breaks out~~ and set the groundwork for the hypothesis which we would wish to explore for this project.

Explore Flight Data Every Month from 2009 to 2018 (Nai Biao)

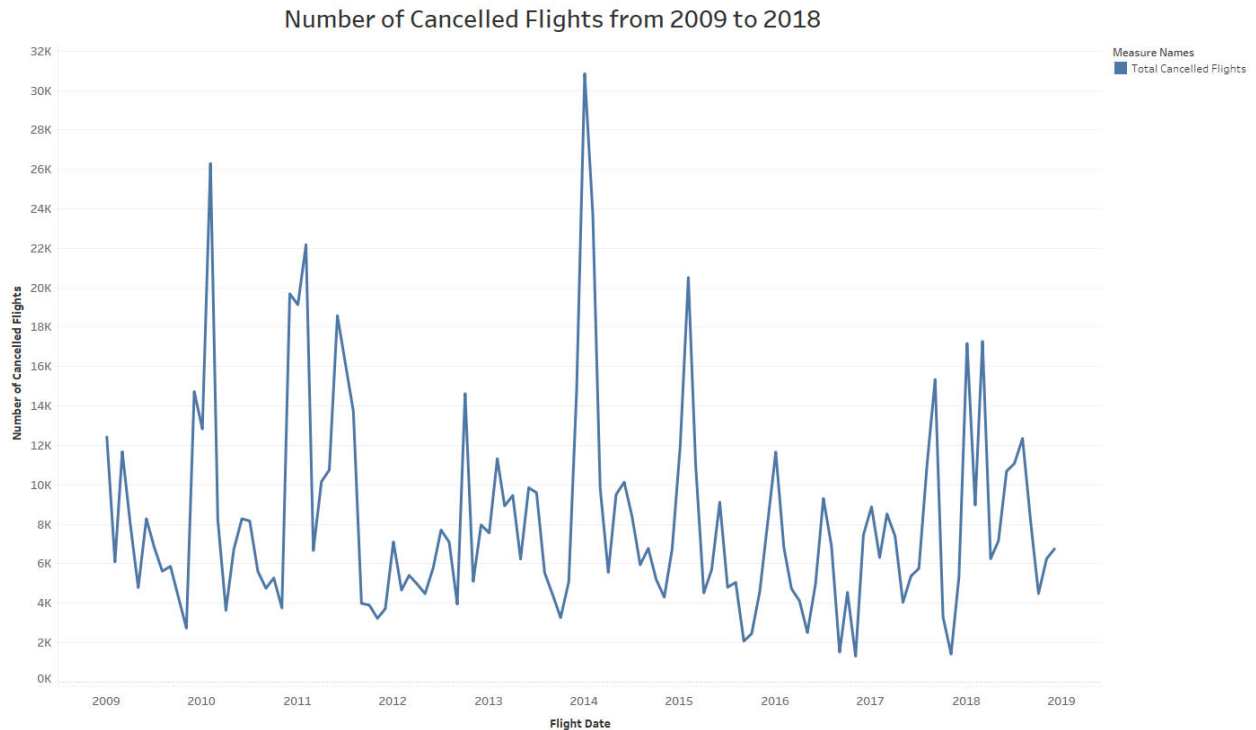
We used a highlighted table in Tableau to represent the number of flights every month from 2009 to 2018. We can observe that September in 2009 and June in 2011 seem to contain two months of flight data, respectively. The numbers of flights in the year 2014, 2016, and 2017 demonstrate a similar pattern, while the numbers in 2010, 2013, and 2018 show a different pattern ways. The Fields, DEP_TIME, and ARR_TIME, in the 2016 flight data have the least missing values. Therefore, we decided to ~~study flight data in 2016~~ explore 2016 flight data for this project.

The Number of Flights Every Month from 2009 to 2018

Year	1	2	3	4	5	6	7	8	9	10	11	12	Total Flights
2009	532,339	488,410	557,422	537,793	546,832	557,594	580,134	568,301	1,021,704		509,540	529,269	410,517 1,057,176
2010	521,809	483,270	549,262	529,330	542,747	551,687	570,788	569,217	526,107	545,519	520,999	539,382	
2011	494,400	455,516	526,687	507,024	520,612	1,057,176		541,442	487,468	504,397	478,040	493,888	
2012	486,133	464,826	521,628	505,218	518,423	526,933	545,131	540,793	490,199	515,254	488,006	494,218	
2013	509,519	469,746	552,312	536,393	548,642	552,141	571,623	562,921	510,806	535,344	503,296	516,739	
2014	471,949	430,602	503,758	483,499	499,278	502,617	520,880	507,491	469,489	491,011	462,054	477,183	
2015	469,968	429,191	504,312	485,151	496,993	503,897	520,718	510,536	464,946	486,165	467,972	479,230	
2016	445,827	423,889	479,122	461,630	479,358	487,637	502,457	498,347	454,878	472,626	450,938	460,949	
2017	450,017	410,517	488,597	468,329	486,483	494,266	509,070	510,451	458,727	479,797	454,162	464,205	
2018	570,118	520,731	611,987	596,046	616,529	626,193	645,299	644,673	585,749	616,101	586,178	593,842	

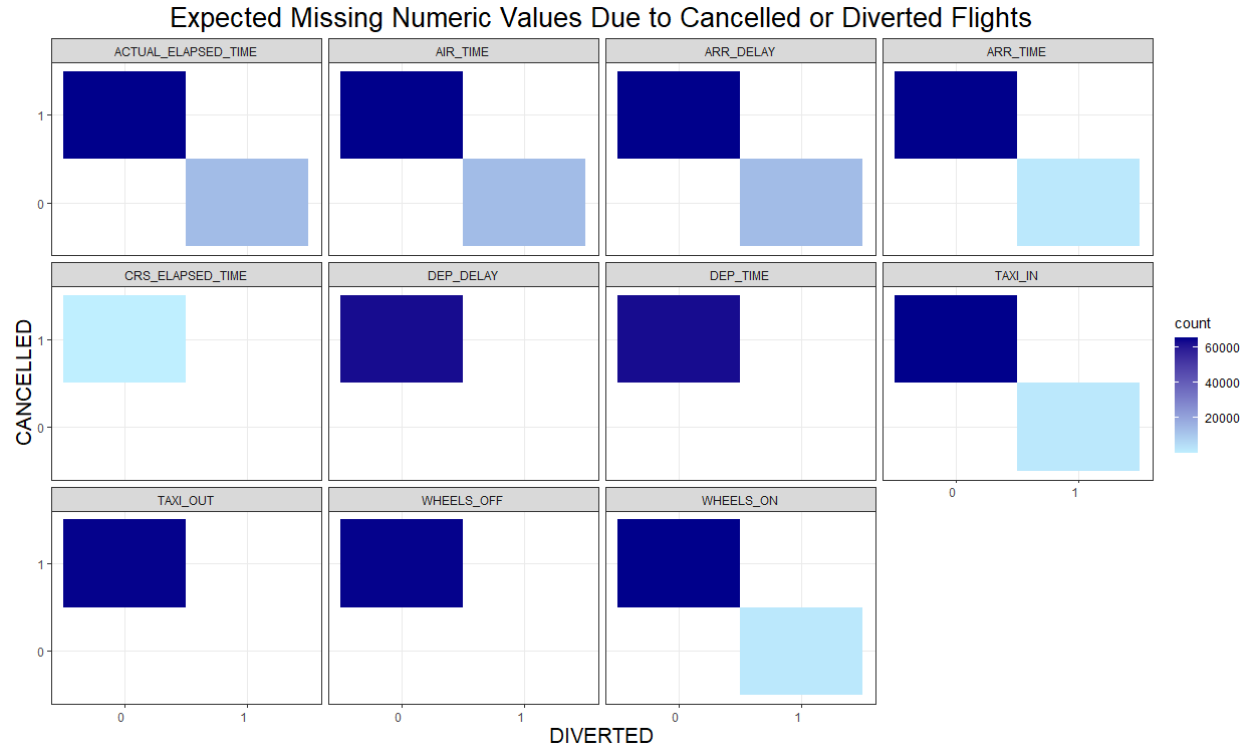
Sum of Total Flights broken down by Month vs. Year. Colour shows sum of Total Flights. The marks are labelled by sum of Total Flights.

We also use the line graph to show the number of canceled flights every month from 2009 to 2010. The line graph demonstrates some degree of seasonality.



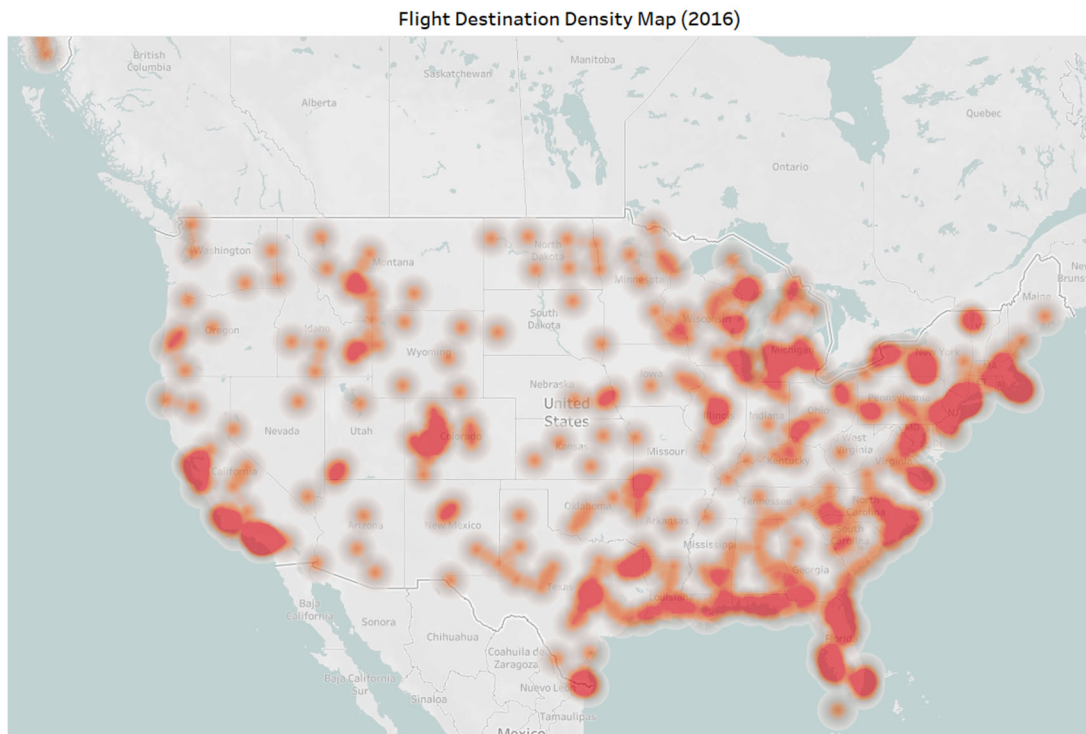
The trend of Total Cancelled Flights for FLT Month Month. Colour shows details about Total Cancelled Flights.

The dataset has many missing values. However, we found all of them are expected. For instance, when a flight is canceled or diverted, it is reasonable that the flight does not have a corresponding ARR_TIME. The contingency plot explains these missed numeric values in more detail.

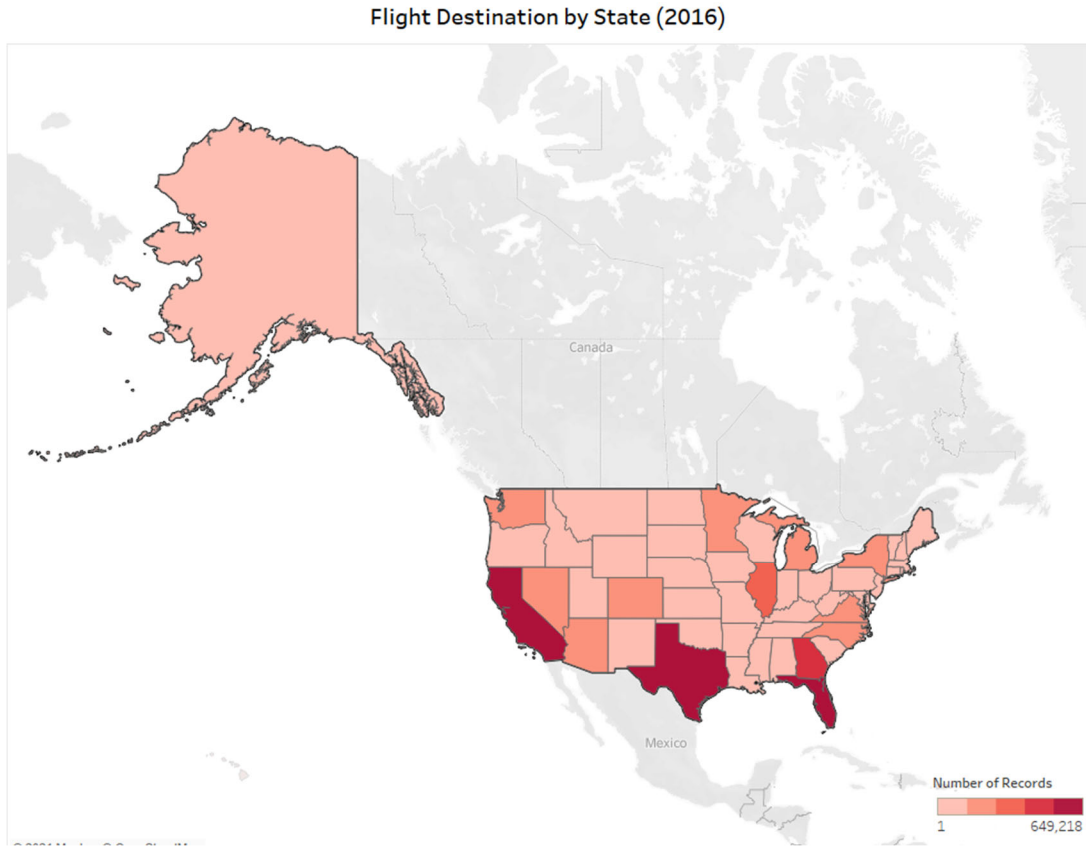


Flight Destination by State (Zhenyu)

The flight destination density map shows that most flights come from California, the East eCoast, the Midwest, Florida and ~~and southern coastlines~~ the Gulf Coasts.

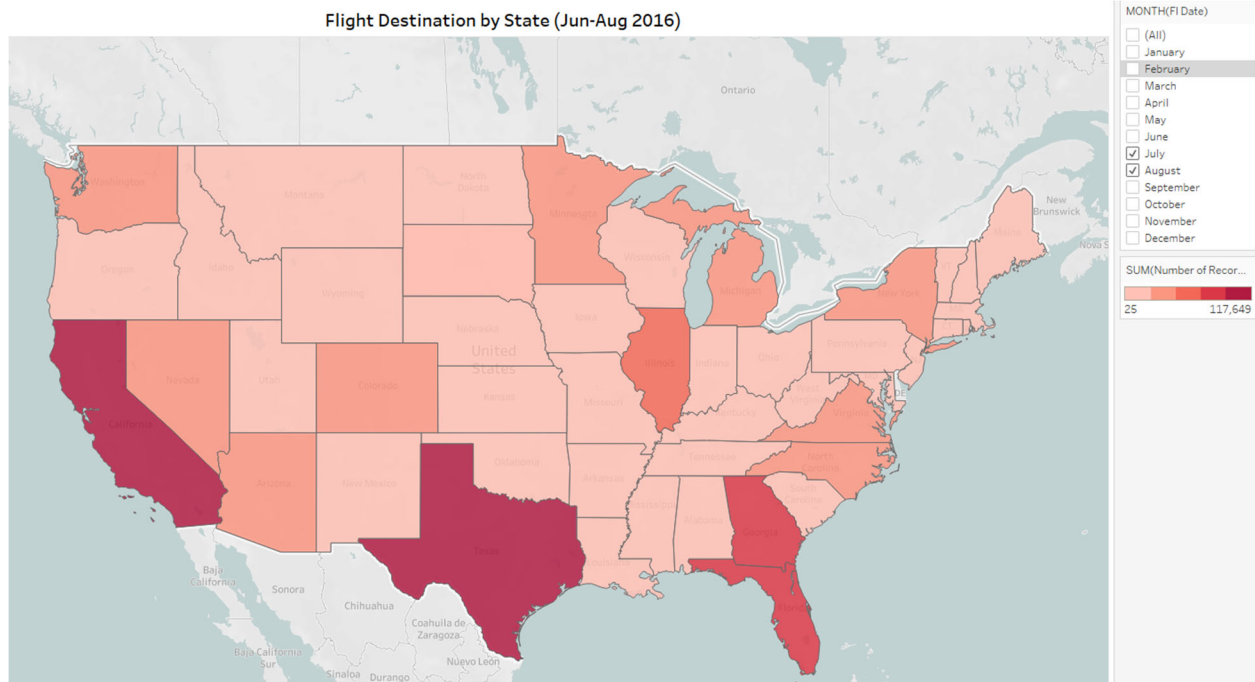


When we aggregate flights by state, we see that three of the most populous states actually had ~~the most~~the greatest number of flights for the year 2016.



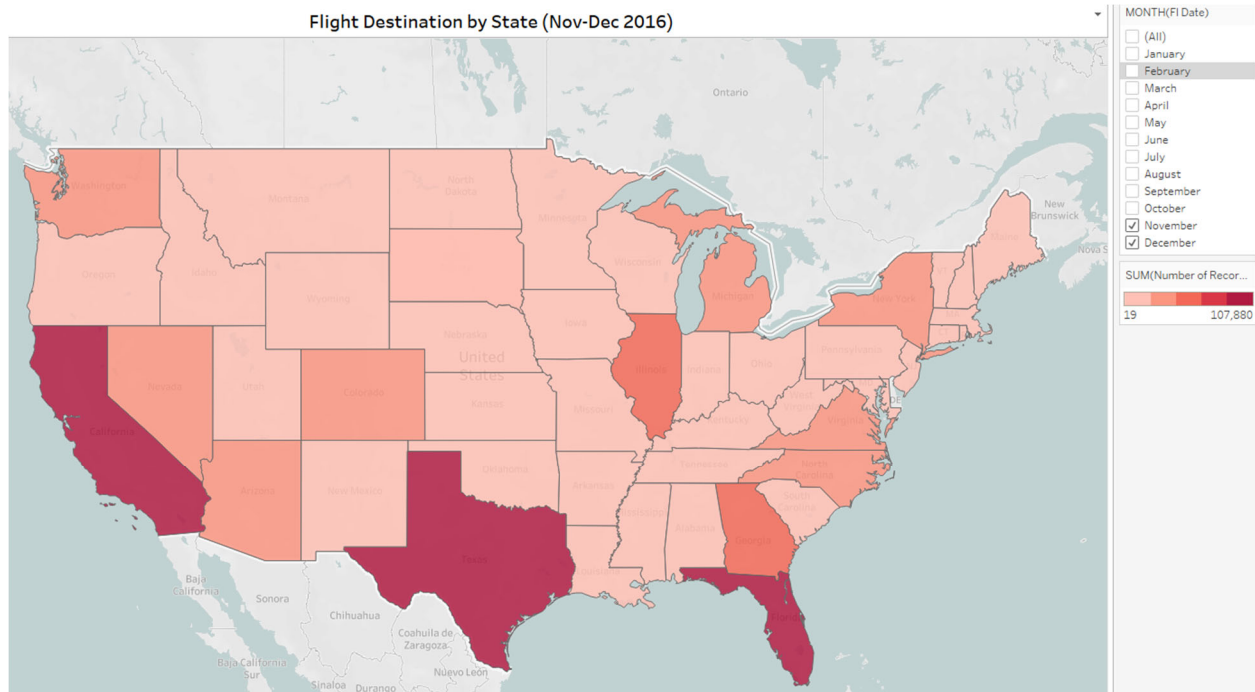
Summer Season

During the summer months (June to August), we see that there is a decline in the number of flights that have Florida as its destination.



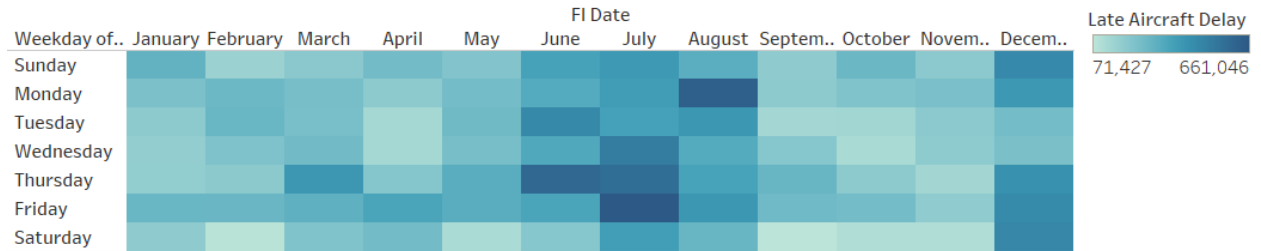
Holiday Season

During the holiday season (November to December), there is an increase in the number of people flights that go have to Florida as its destination.



Aircraft Delay by Days and Months (Adil)

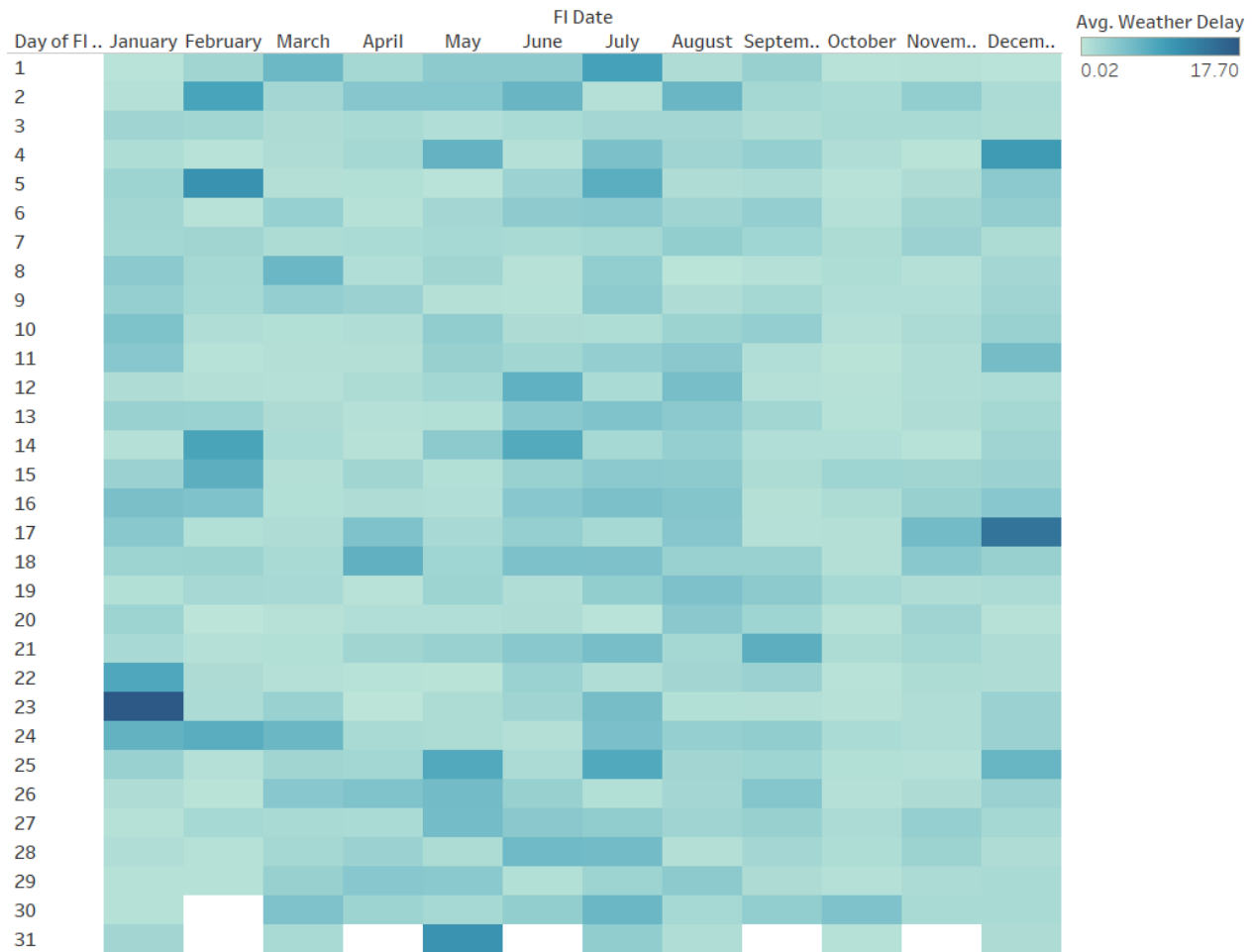
Late Aircraft Delay by Weekday



Sum of Late Aircraft Delay (color) broken down by FI Date Month vs. FI Date Weekday.

December and January are not as high as expected compared to summer months such as June, July, and August. Is this due to the sheer quantity of flights for vacation?

Weather Delay by Day



Average of Weather Delay (color) broken down by FI Date Month vs. FI Date Day.

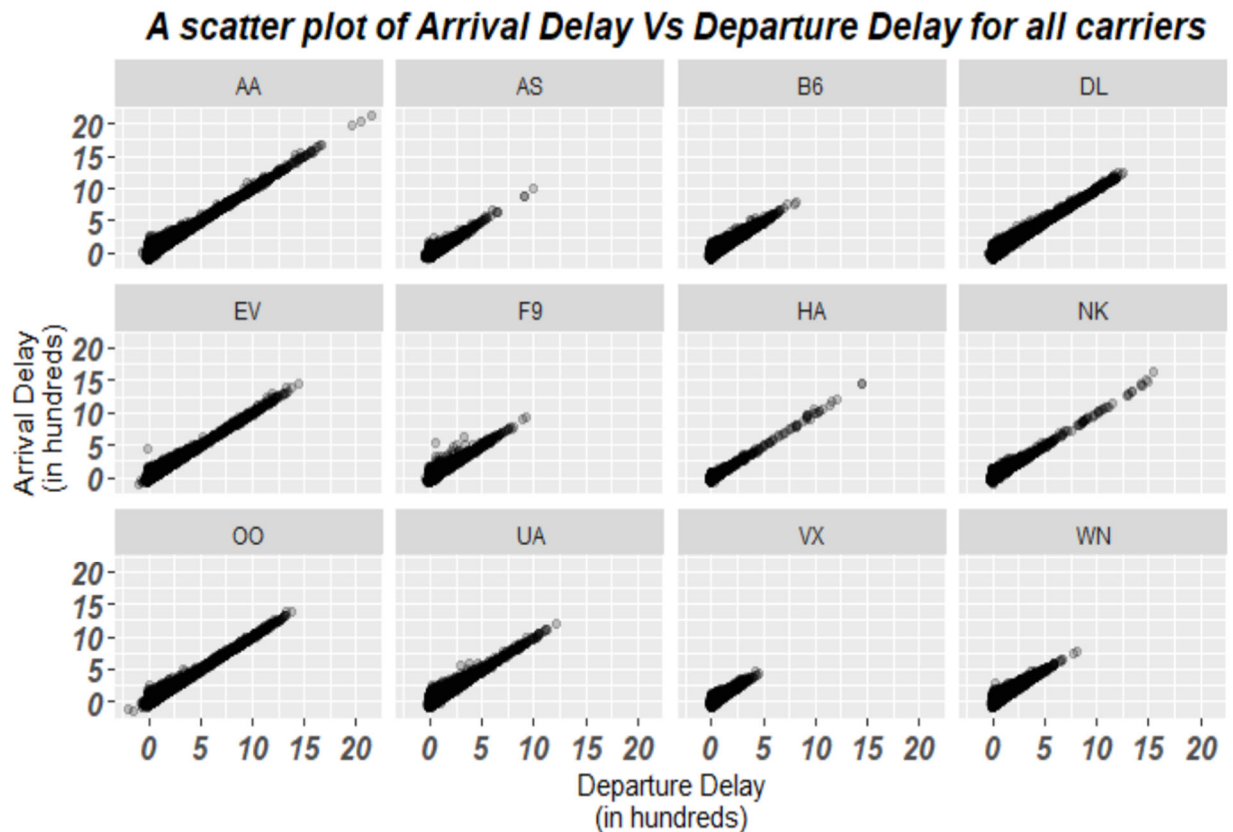
Jan 23: Huge snowstorm hits mid-Atlantic and northeastern states

Dec 17: Large snowstorm hits areas such as New York

These explain the outliers, overall, there seems to be an even spread of weather delays regardless of the month.

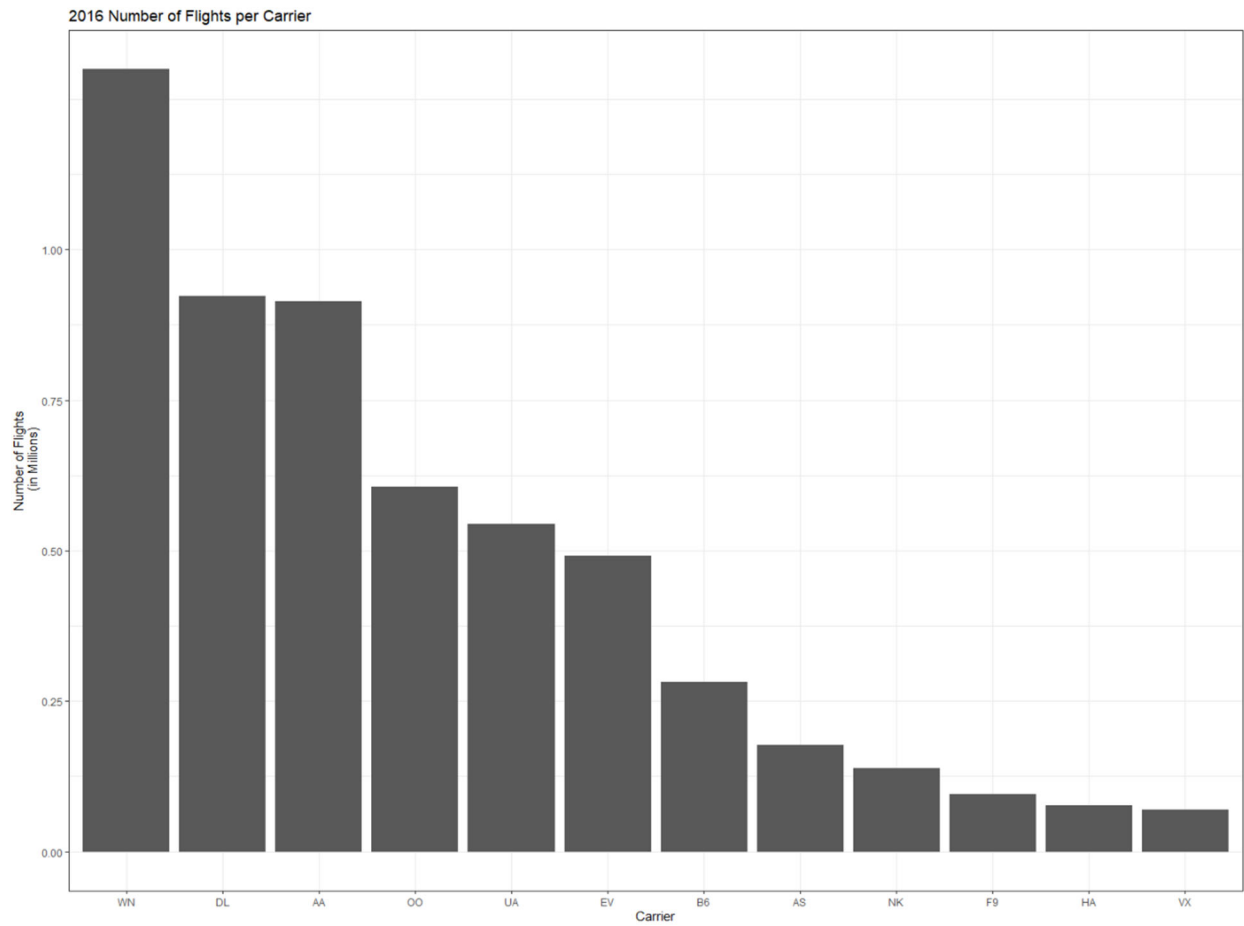
Perform Exploratory and Explanation Analysis (Ronaldlee)

(1), A scatter plot of Arrival Delay Vs Departure Delay for all Carriers

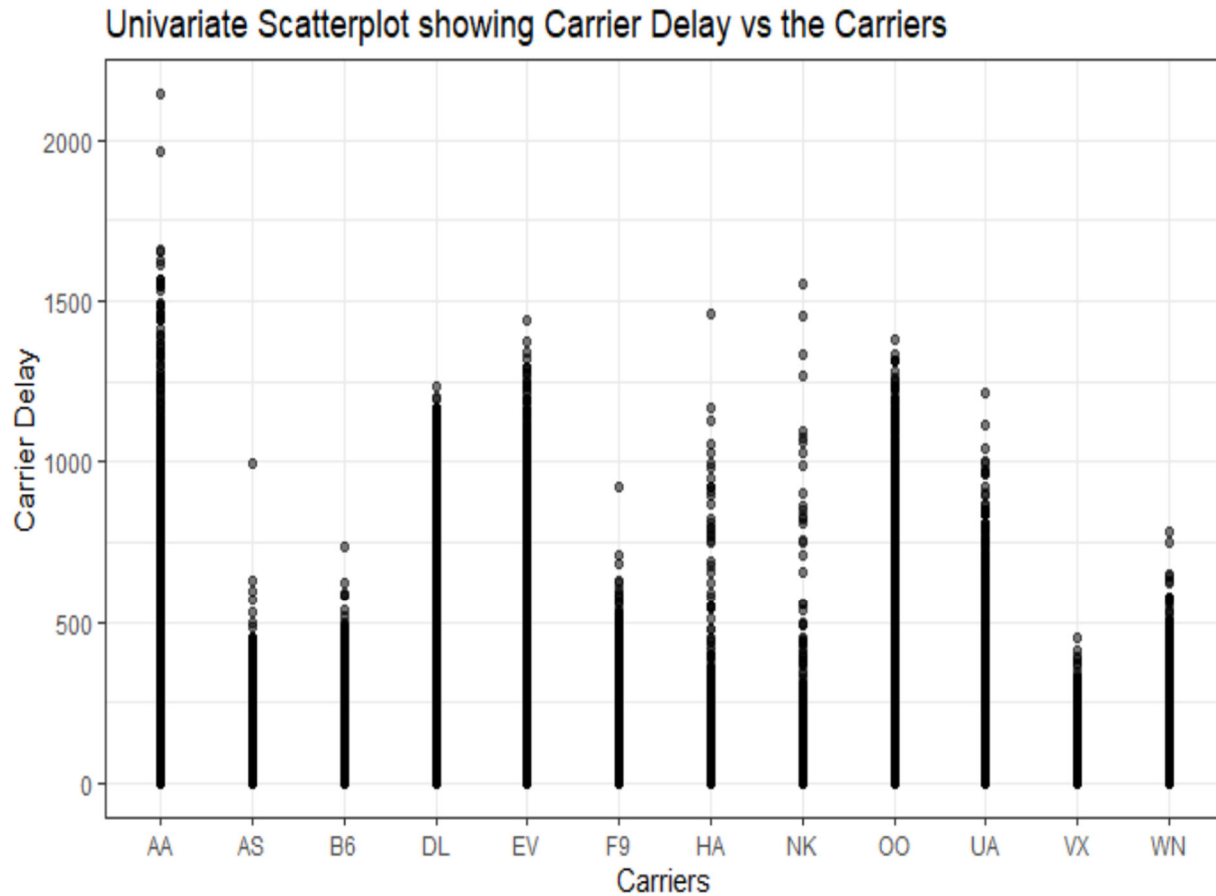


From the scatter plot above, we learned that there is a positive relationship between departure delay and arrival delay. -meaning- This is within reason since that as departure delay increases, arrival delay tends to increase as well since the required time for a specific flight will be constant.

(2), 2016 Number of Flights per Carrier

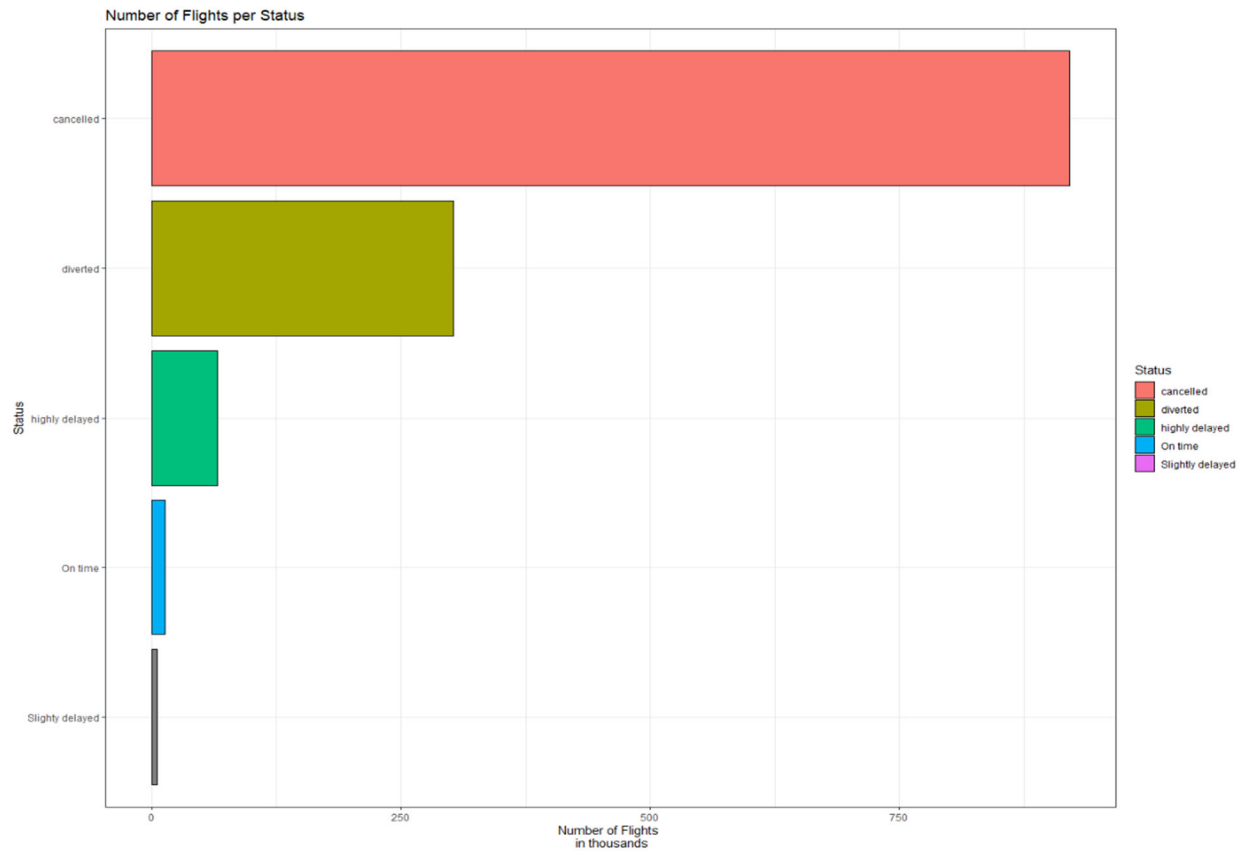


(3), Univariate Scatter plot of Carrier Delay Vs Carriers



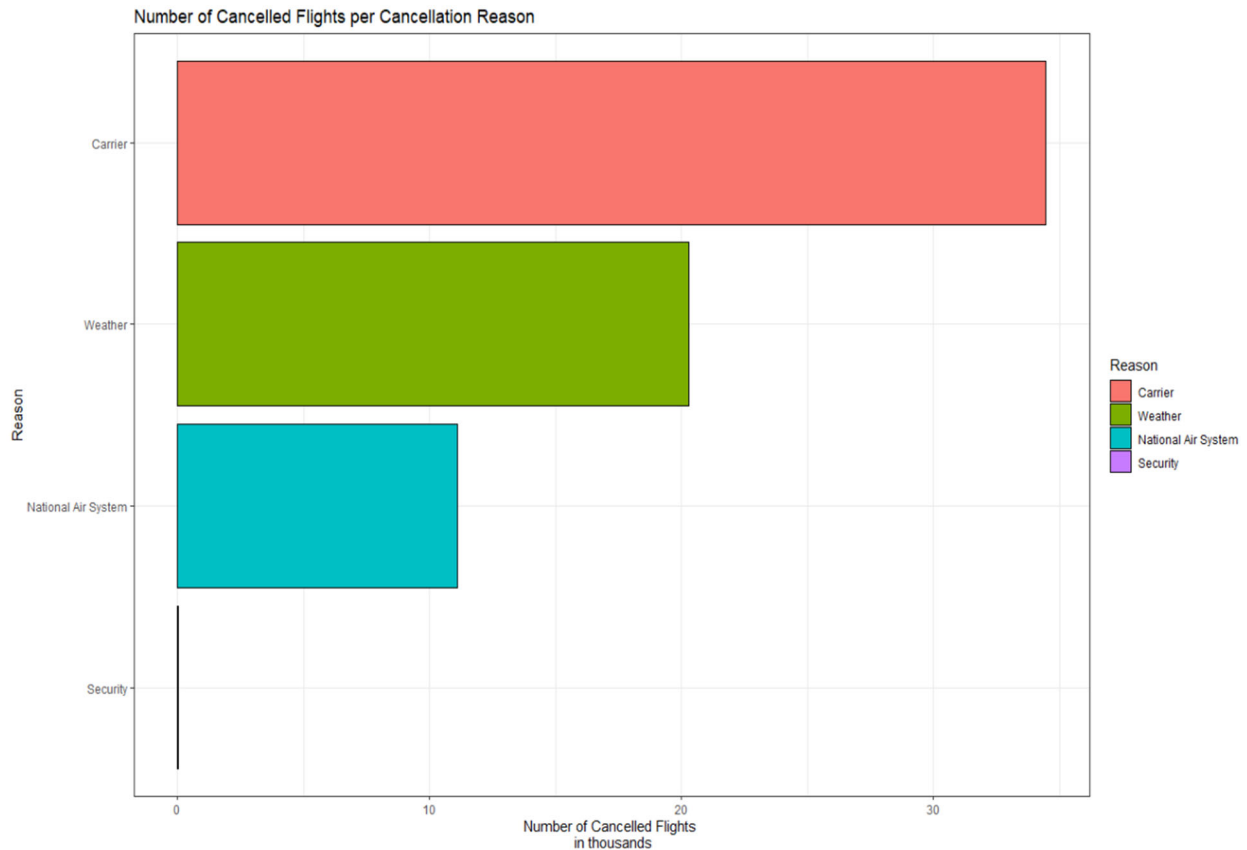
The above univariate scatter plot visualizes the distribution of Carrier delay against the different carriers that operated in 2016. From the scatter plot, we learned that American Airlines experienced the most the greatest number of delays and Virgin America (VX) had the least amount of carrier delays.

(4), Number of Flights per Status



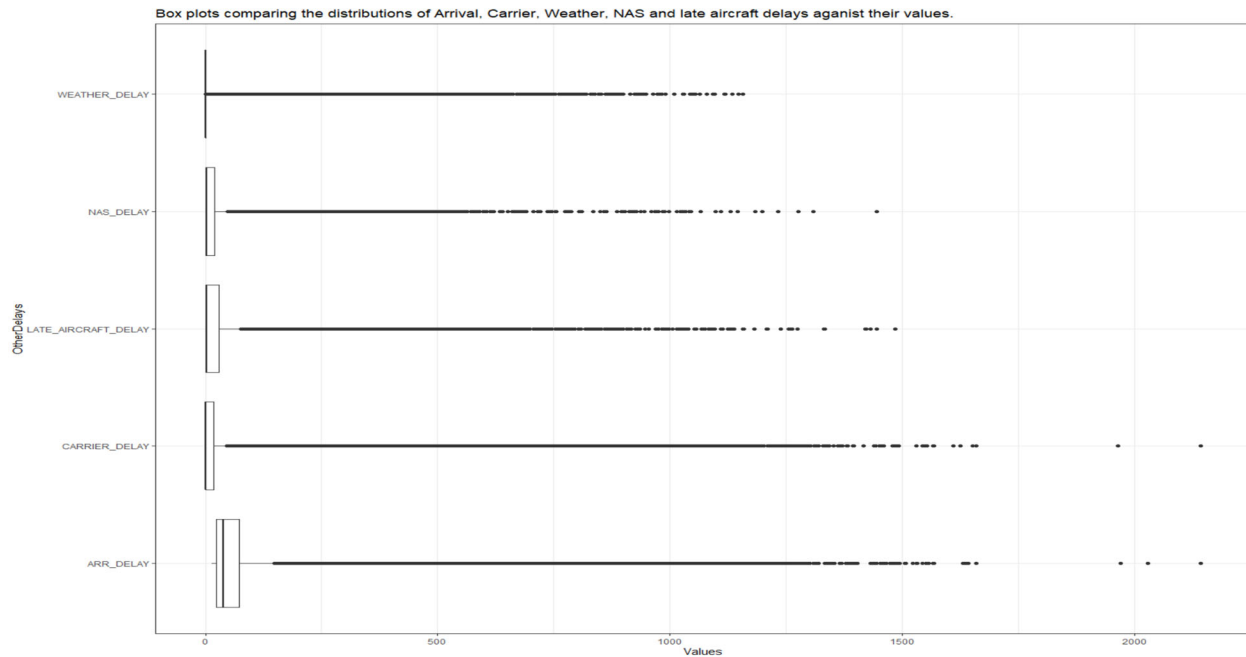
The bar graph indicates that a lot of flights were cancelled compared to those that were diverted.

(5), Number of Cancelled Flights per Cancellation Reason



Amongst the cancelled flights we learn that carrier reason dominates amongst all the other reasons especially when the planes are experiencing technical difficulties then weather comes in the next position as one of the other reasons why flights were cancelled in 2016. We see that security takes a small percentage as one of the reasons why the flights were cancelled.

Comparing the distributions of Arrival, Carrier, Weather, NAS and late aircraft delays against their values.



The above box plot shows the distribution of Arrival, Carrier, Weather, NAS and late aircraft delays against their values. We notice that they are potential outliers, which need to be investigated and removed amongst all the different delays.