

## Assignment 1: Air Transportation

Date Due: January 29, 2024

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### Problem 1

Familiarize yourself with the Great Circle Mapper application (<http://www.gcmap.com/>). Plan two trips from Kennedy Airport (JFK) airport as follows: 1) JFK to ATL and 2) JFK to SDQ (Santo Domingo, Dominican Republic).

- Extract the great circle distance for these flights.
- Now use the Flightaware web application (<http://flightaware.com/>) and extract flight information for two random flights flown between those cities in the past 10 day (just pick one day of the last 10 days) using the Boeing 737-900 aircraft (aircraft designator is B739 in Flightaware).
- Compare the actual distances filed in the pilot's flight plan (the flight plan distances are labeled as "Planned" in Flightaware.com) versus the great circle distances. Comment on the detour factor observed for each of the flights. The detour factor is the ratio of the distance flown and the great circle distance calculated by the mapper <http://www.gcmap.com/>.
- State the cruise flight levels (i.e., altitude in feet divided by 100) and cruise speed filed in the flight plan for the flights selected in part(b) and comment on the altitudes and speed flown.

### Problem 2

Use airport and airline passenger data available at the BTS site.

- Use the **Aviation Database T-100 Domestic Market** to extract the number of **passengers enplaned** at Denver International Airport (DEN) and Roanoke-Blacksburg Regional Airport (ROA) airports in the past 3 years. Make a plot and comment on the results observed. The T-100 database is available at the BTS web site ([www.transtats.bts.gov](http://www.transtats.bts.gov)).
- Show the effect of Covid (years 2020-2022) in the number of flights at the airports in question. Comment if the passenger traffic at the airports has recovered.

### Problem 3

BTS airline fares and emplacement data.

- Use the Aviation Database **T-100 Domestic Segment** to extract the number of **enplaned passengers** and **seats offered** at the Denver International Airport (DEN) in years 2019 - 2023. Make a plot (or a bar chart) and comment on the results observed.
- Plot the on-time performance of flights at DEN in the same period. Comment on the on-time performance observed during Covid. Briefly comment.
- Air fares are critical in the estimation of aviation demand. Use the BTS site to estimate average fares in the US for the period 2015-2023. Comment on the possible explanation about the decrease in air fares over time.

### Problem 4

Fuel consumption and Greenhouse gases.

- Collect the data and plot the fuel cost paid by (in \$/gallon) of the US commercial airlines with scheduled service (more than \$20 million in revenue per year) for years 2015-2023. The fuel consumption data can be found at the BTS web site (<https://www.transtats.bts.gov/fuel.asp>). Comment on the observed trends.
- Plot the domestic fuel consumption (in gallons) of the US commercial airlines with scheduled service (more than \$20 million in revenue per year) for years 2015-2023 (November 2023 if OK). The fuel consumption data can be found at the BTS web site (<https://www.transtats.bts.gov/fuel.asp>).
- Estimate the Greenhouse Gases (GHG) produced by US commercial airlines in 2023 knowing that a pound of Jet-A fuel produces 3.125 pounds of CO<sub>2</sub>. Compare the Greenhouse emissions of 2023 and the first year of Covid (2020).

D) Overall, what was the reduction in GHG during Covid?

**Problem 5**

Download the Landing Events Database developed by Virginia Tech for the FAA. You can download the installer (in the middle of the web page) at the following web link (Air Transportation Systems Lab).

<https://atsl.cee.vt.edu/products/runway-exit-design-interactive-model--redim-1.html>

Using data for the year 2019 answer the following questions:

- A) Find the average landing (ground) speed over the runway threshold for Airbus A319 (A319) aircraft landing on runway 19 at DCA (National Reagan Airport).
- B) Compare the speeds found against the Eurocontrol database (<https://contentzone.eurocontrol.int/aircraftperformance/default.aspx?ICAOFilter=A319>).
- C) Find the runway occupancy time (time spent on the runway during landing) of the Airbus A319 (A319) population landing on runway 19 at DCA airport.
- D) Show the cumulative density plot (CDF) of the runway occupancy times for Boeing 737-800 (B738) landing on runway 19 at DCA.
- E) Comment on any differences observed between the approach speeds of the Airbus A319 and the Boeing 737-800.