

**Crazy Coders:** <https://github.com/serenashen1/FinalProject-CrazyCoders.git>

Charlotte Parent, Nicolina Moore, Serena Shen

### **1. The goals for your project include what APIs/websites you planned to work with and what data you planned to gather (10 points)**

In our Project Plan, we had discussed using four APIs in order to compare different children's shows and networks from our childhood. The APIs we had planned to use were the following: Disney API, PBS Kids API, and Cartoon Network API.

We wanted to gather data regarding the different television shows on each network, the hours they operated during the day, the amount of views each show/network received, the rating of each show, and how long each show ran for.

With this data, we were going to calculate the most popular show per channel, the least popular show per channel, and the most popular time to watch each show/channel.

We had planned to create visualizations on Matplotlib of this data by using...

- A graph/scatter plot to compare each network and the times people watched the shows
- A graph showing change in popular/most-watched show over time for each channel
- A chart depicting most popular and least popular shows on each channel
- A bar chart showing average rating per channel

After realizing we did not have enough items to meet the requirements through these APIs, we decided to change the direction of our project and create a new plan with different APIs and goals in mind.

### **2. The goals that were achieved including what APIs/websites you actually worked with and what data you did gather (10 points)**

The first goal we achieved was to find our new APIs. Since we switched the direction of our project, we looked on the website [API Ninjas](#) and ended up finding APIs we could work with. We used an Airport API, Air Quality API, Country API, and for extra credit, we used a fourth API called Weather API for the extra credit.

Air Quality API: <https://api.api-ninjas.com/v1/airquality>

Airport API: <https://api.api-ninjas.com/v1/airports>

Country API: <https://api.api-ninjas.com/v1/country>

Weather API: <https://api.api-ninjas.com/v1/weather>

The next goal we achieved was to create relationships based off of the data gathered, as we were interested in the averages within the air and travel economy, as they are closely related. From there, we made three calculations based on the data we collected:

1) Our first calculation was to determine the average number of refugees in each country based on the airport's timezone.

We wanted to determine the best time for volunteers and people around the world who dedicate their time and have interest in helping refugees through the community and help provide resources, so determining the airport with the highest number of refugees at a given time helped us achieve our goal – as these volunteers now know the best time/time zone to help.

2) Our second calculation was to determine the number of tourists (more than 200 per country) and the average elevation of that country.

We wanted to determine the number of tourists per country and the average elevation of that country, as it would help us determine what kinds of destinations/vacations people are most interested in. If there are a lot of tourists traveling to higher elevations, this would help us conclude that travelers enjoy more mountainous vacations, where if the elevation is lower we can assume travelers enjoy visiting warmer locations closer to sea level.

3) Our third calculation was to determine the average air quality in a country and the country's average population size.

We wanted to determine the average air quality in countries and determine their average population as it will help us conclude how certain countries use their resources such as natural gas, gas, and wood – and could help us conclude how much resources, waste, or fuel is used based on how healthy or unhealthy the air is.

We used Google Sheets to organize the content within each API and our databases before we took the next step of physically calculating the data and creating the visualizations.

The data we evaluated for each calculation:

<b>airports</b>		<b>airports</b>	<i>Airport API</i>					<b>Visualizations</b>	
airports		Name	Type	Description	Key			Average	
airport_locations		ID	int	Airport ID	Primary key				
weather		city_ID	int of city						
country_info		IATA_code							
air_quality		name	name of airport	name of airport					
		<b>airport_locations</b>	<i>Airport API</i>						
		Name	Type	Description	Key				
		ID	int	Airport location ID	primary key				
		country_ID	int	ID of the country-- link to country table					
		city_name	text	City of the airport					
		region	text	Region of the airport					
		timezone	date	Timezone of the airport					
		latitude	int	Lat. of the airport					
		longitude	int	Long. of the airport					
		elevation	int	Elevation of the airport					
		<b>weather</b>	<i>Weather API</i>						
		Name	Type	Description	Key				
		ID	int	ID	Primary key				
		city_ID	int	ID of city					
		country_ID	int	ID of country					
		wind_speed	int	wind speed					
		wind_degrees	int	Temperature (deg) of wind					
		temperature	int	Temperature of location					
		humidity	int	Humidity %					
		sunset	string	Sunset time					
		sunrise	string	Sunrise time					
		cloud_pct	int	Cloud cover percent					
		feels_like	int	"Feels like" temperature					
		max_temp	int	Max temperature					
		min_temp	int	Min temperature					
		<b>country</b>	<i>Country API</i>						
		Name	Type	Description	Key				
		ID	Int	Country ID	Primary key				
		name	text						
		gdp	int						
		surface_area	int						
		life_expectancy_male	int						
		imports	text	Number of imports					
		currency_name	text						
		urban_population_growth	int						
		capital	text	Capital					
		tourists	int						
		life_expectancy_female	int						
		threatened_species	text						
		population	int						
		urban_population	int						
		pop_growth	int						
		region	text						
		pop_density	int						
		refugees	int						
		<b>air_quality</b>	<i>Air Quality API</i>						
		Name	Type	Description	Key				
		ID	int	ID	Primary key				
		city_ID	int	city ID					
		country_ID	int	country_ID					
		AQI	int	Air Quality Index					
		CO	int	CO percentage					

### 3. The problems that you faced (10 points)

The first problem we encountered was changing our entire project plan and coming up with a new project that would allow more connections and conclusions to be made within the data given.

The second problem we encountered was merging our work on VSCode so all three of us could make edits and changes. After several attempts, we finally figured it out and set up a system that forced us to all stop and push and pull our code together.

The third problem we encountered was with the foreign keys. Everytime we added the foreign keys when creating each table, we kept getting errors and started to overcomplicate our code.

The next problem we faced is when inputting the cities and countries into airport.py, there were multiple airports in countries that had multiple cities of the same name. Therefore, we had to go through the output data and see which cities were duplicated and what we already had in our databases to ensure there were no repeats again. As a result, we had to hardcode some of our cities to ensure they only appear once.

The next problem we encountered was when we created our databases, we couldn't get all 100 rows to show up, only the first 25. We ended up forgetting to add SELECT and VSCode kept giving us errors for the cities and countries we had inputted, and every time we ran it the ones that were problematic would change. It took a very long time to debug this, but we ended up figuring it out.

### 4. The calculations from the data in the database (i.e. a screenshot) (10 points)

1)

```
8
9 # 1st visualization - average number of refugees in each country based on the airport's timezone
10
11 def avg_timezones(cur):
12
13     cur.execute("SELECT l.timezone, AVG(c.refugees) FROM airport_locations l JOIN country c ON l.ID = c.ID WHERE c.refugees > 200 GROUP BY l.time")
14     data = cur.fetchall()
15
16     africa_timezones = []
17     america_timezones = []
18     asia_timezones = []
19     europe_timezones = []
20
21     for country in data:
22         # print(country)
23         if "Europe" in country[0]:
24             europe_timezones.append(country)
25         elif "America" in country[0]:
26             america_timezones.append(country)
27         elif "Asia" in country[0]:
28             asia_timezones.append(country)
29         elif "Africa" in country[0]:
30             africa_timezones.append(country)
31
32     avg_refugees_timezone = []
33
34     for country in data:
35         avg_refugees_timezone.append(country[1])
36
37     avg_refugees_timezone.sort()
38     # print(avg_refugees_timezone)
39
```

```

40 x = avg_refugees_timezone
41 y = ["Africa/Bujumbura", "Africa/Conakry", "Africa/Johannesburg", "Africa/Khartoum", "Africa/Maputo", "Africa/Nairobi", "America/Chicago", "A
42 plt.barh(y, x, color = "pink")
43 plt.xlabel("Average Number of Refugees per Time Zone")
44 plt.ylabel("Time Zone of Country")
45 plt.title('Average # of Refugees per Country vs. Time Zone of Country')
46 plt.show()
47
48 highest_ref = max(avg_refugees_timezone)
49 lowest_ref = min(avg_refugees_timezone)
50
51 total_ref= 0
52 for num in avg_refugees_timezone:
53     total_ref += num
54 total_ref = total_ref/len(avg_refugees_timezone)
55
56 highest_tz= ""
57 lowest_tz = ""
58
59 for country in data:
60     if country[1] == highest_ref:
61         highest_tz = country[0]
62     if country[1] == lowest_ref:
63         lowest_tz = country[0]
64
65 with open('avg_timezones.txt', 'w') as f:
66     f.write("In the " + highest_tz + " timezone, the average number of refugees was " + str(round(highest_ref)) + ". This is the highest average number of refugees in a timezone."
67     f.write("In the " + lowest_tz + " timezone, the average number of refugees was " + str(round(lowest_ref)) + ". This is the lowest average number of refugees in a timezone."
68     f.write("Across all timezones, the average number of refugees is " + str(round(total_ref)) + ".")
69
70 f.close()
71

```

```

≡ avg_timezones.txt
1 In the Europe/Vilnius timezone, the average number of refugees was 6387. This is the highest average number of refugees in a timezone.
2 In the Africa/Conakry timezone, the average number of refugees was 226. This is the lowest average number of refugees in a timezone.
3 Across all timezones, the average number of refugees is 1318.

```

2)

```

18
19 # 2nd calculation - number of tourists more than 200 vs elevation (scatterplot)
20 #reasoning: tourists wanna go to places with higher elevations/mountains maybe??
21
22 def avg_tourists(cur):
23
24     elevations = []
25     num_tourists = []
26
27     cur.execute("SELECT c.tourists , l.elevation, l.city FROM country c JOIN airport_locations l ON c.ID = l.ID WHERE l.elevation > 200 ORDER BY l.elevation")
28     # cur.execute("SELECT MAX(c.tourists) , l.elevation, l.city FROM country c JOIN airport_locations l ON c.ID = l.ID WHERE l.elevation > 200 ORDER BY l.elevation")
29     data = cur.fetchall()
30
31     for country in data:
32         num_tourists.append(country[0])
33         elevations.append(country[1])
34
35     # print(elevations)
36     # print(num_tourists)
37
38     plt.scatter(num_tourists, elevations)
39     plt.xlabel("Number of Tourists (more than 200) per Country")
40     plt.ylabel("Country Elevation (ft)")
41     plt.title('Number of Tourists per Country vs. Country Elevation (ft)')
42     plt.show()
43
44     cur.execute("SELECT AVG(c.tourists) , l.elevation, l.city FROM country c JOIN airport_locations l ON c.ID = l.ID WHERE l.elevation > 9000 GROUP BY l.elevation")
45     over_9k = cur.fetchall()
46
47     with open('average_tourists_elevation.txt', 'w') as a:
48         a.write("The average number of tourists where the elevation is greater than 9,000 feet is " + str(over_9k[0][0]) + ".")
49
50

```

```

≡ average_tourists_elevation.txt
1 In countries where the elevation is high, the average number of tourists is 4221.
2 In countries where the elevation is in the middle, the average number of tourists is 14694.
3 In countries where the elevation is low, the average number of tourists is 12210.

```

3)

```
104 def avg_AQI(cur):
105
106     cur.execute("SELECT q.AQI, c.name, c.population FROM air_quality q JOIN country c ON q.ID = c.ID")
107     data = cur.fetchall()
108
109     good = []
110     moderate = []
111     unhealthy_s = []
112     unhealthy = []
113     v_unhealthy = []
114     no_data = []
115
116     for i in range(len(data)):
117         # print(data[i][0])
118         # print(data[i][1])
119         if data[i][0] == -1:
120             no_data.append(data[i])
121             # print(no_data)
122         elif data[i][0] > 0 and data[i][0] <= 50:
123             good.append(data[i])
124         elif data[i][0] >= 51 and data[i][0] <= 100:
125             moderate.append(data[i])
126         elif data[i][0] >= 101 and data[i][0] <= 150:
127             unhealthy_s.append(data[i])
128         elif data[i][0] >= 151 and data[i][0] <= 200:
129             unhealthy.append(data[i])
130         elif data[i][0] >= 201 and data[i][0] <= 250:
131             v_unhealthy.append(data[i])
132
133     good_total = 0
134     mod_total = 0
135     unhealthy_s_total = 0
136     unhealthy_total = 0
```

```
137
138     # edit the data, make it rounded
139
140     for each_country in good:
141         # print(each_country[2] * 1000)
142         good_total += each_country[2] * 1000
143     good_avg = round(good_total/len(good))
144
145     for each_country in moderate:
146         mod_total += each_country[2] * 1000
147     mod_avg = round(mod_total/len(good))
148
149     for each_country in unhealthy_s:
150         unhealthy_s_total += each_country[2] * 1000
151     unhealthy_s_avg = round(unhealthy_s_total/len(good))
152
153     for each_country in unhealthy:
154         unhealthy_total += each_country[2] * 1000
155     unhealthy_total_avg = round(unhealthy_total/len(good))
156
157     x = ["Good", "Moderate", "Unhealthy for Some", "Unhealthy for All"]
158     y = [good_avg, mod_avg, unhealthy_s_avg, unhealthy_total_avg]
159
160     plt.bar(x, y, color = "red")
161     plt.xlabel('AQI (Air Quality Index) Category')
162     plt.ylabel('Average Population Size of Country (in 100 millions)')
163     plt.title('AQI vs. Average Country Population Size')
164     plt.show()
165
```

avg\_pop\_AQI.txt

```
1 The average population of a country with a 'Good' Air Quality Index is 50192120.
2 The average population of a country with a 'Moderate' Air Quality Index is 74414720.
3 The average population of a country with a 'Unhealthy (for some)' Air Quality Index is 18739760.
4 The average population of a country with a 'Unhealthy (for all)' Air Quality Index is 34201600.
5
```



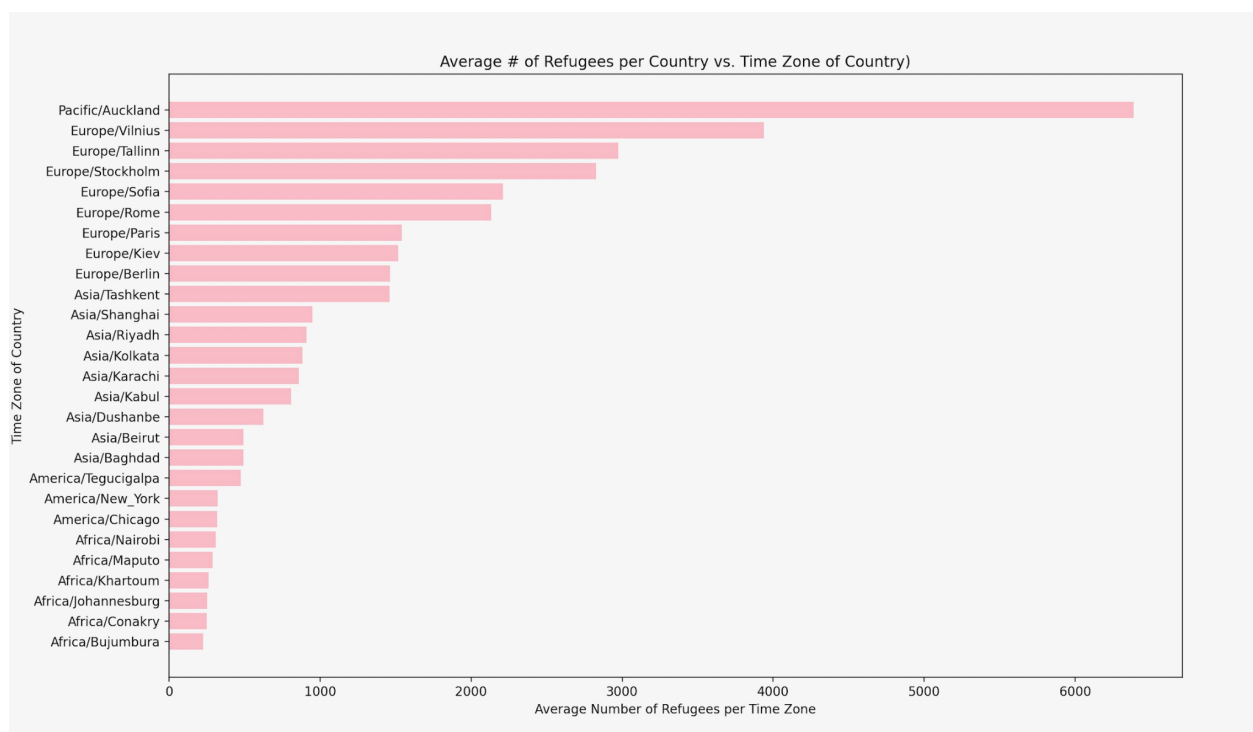
```

213
214 def ec_weather(cur):
215
216     humidity = []
217     species = []
218
219     cur.execute("SELECT w.city, w.humidity, c.threatened_species FROM weather w JOIN country c ON w.ID = c.ID WHERE w.humidity!= -1 AND w.humidity")
220     data = cur.fetchall()
221
222     for each in data:
223         humidity.append(each[1])
224         species.append(each[2])
225     # if each[1] == -1:
226     #     continue
227     # print
228     # species.sort()
229     plt.barh(species, humidity, color = "plum")
230     plt.ylabel("Number of Threatened Species")
231     plt.xlabel("Humidity in Country (in countries where humidity is less than 50 F) (deg. F)")
232     plt.title("Number of Threatened Species vs. Humidity (deg. F)")
233     plt.show()
234
235
236 max_species = max(species)
237 min_species = species[4]
238 max_humidity = 0
239 min_humidity = 0
240
241 for i in range(len(humidity)):
242     if species[i] == max_species:
243         max_humidity = humidity[i]
244     elif species[i] == min_species:
245         min_humidity = humidity[i]
246
247 with open('weather_ec_calc.txt', 'w') as f:
248     f.write("The largest number of threatened species, " + str(max_species) + ", is located in country with " + str(max_humidity) + " humidity")
249     f.write("The smallest number of threatened species, " + str(min_species) + ", is located in country with " + str(min_humidity) + " humidity")
250     f.close()

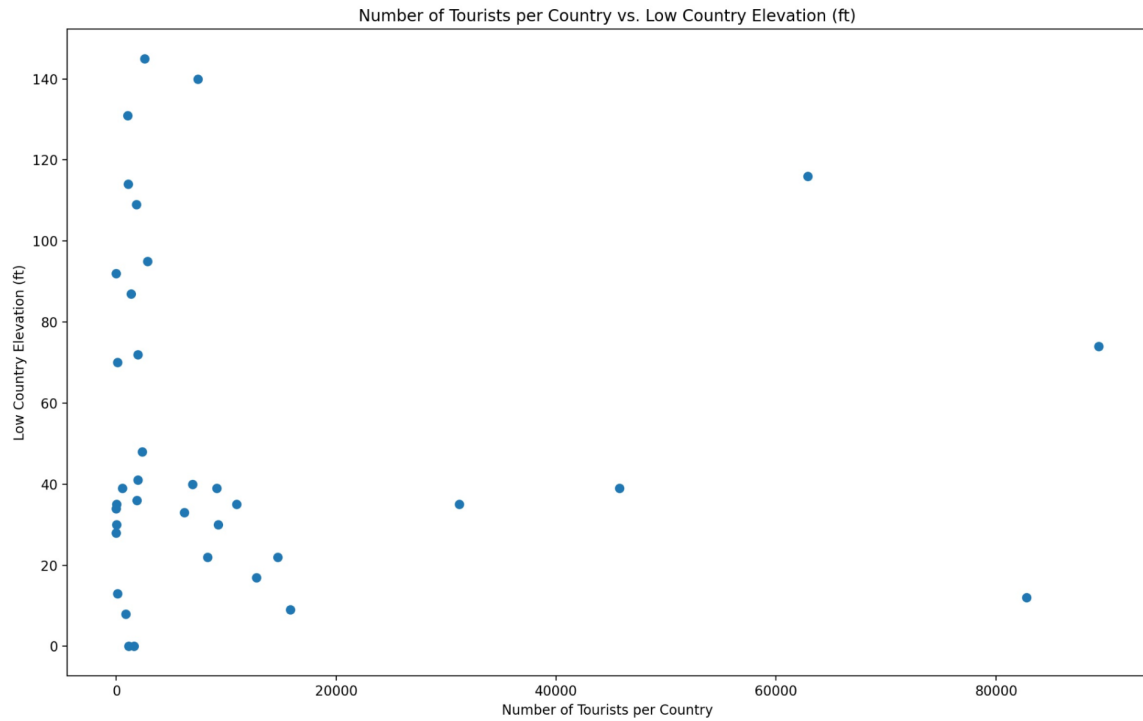
```

## 5. The visualization that you created (i.e. screenshot or image file) (10 points)

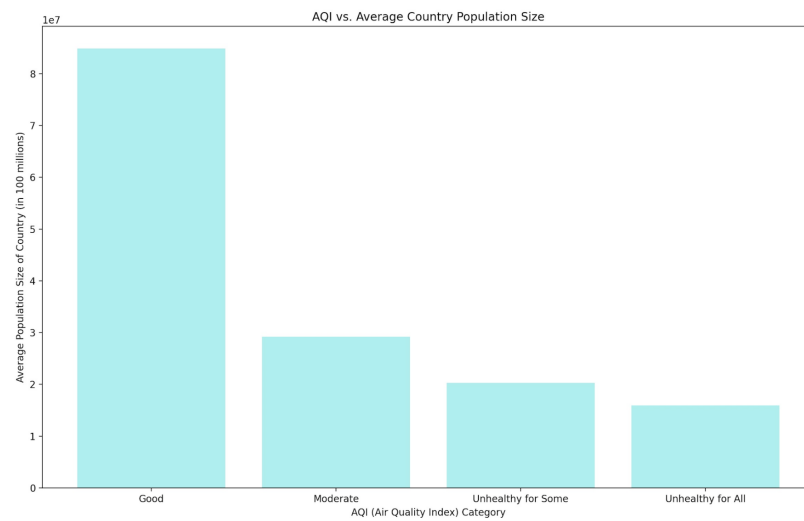
1)



2)



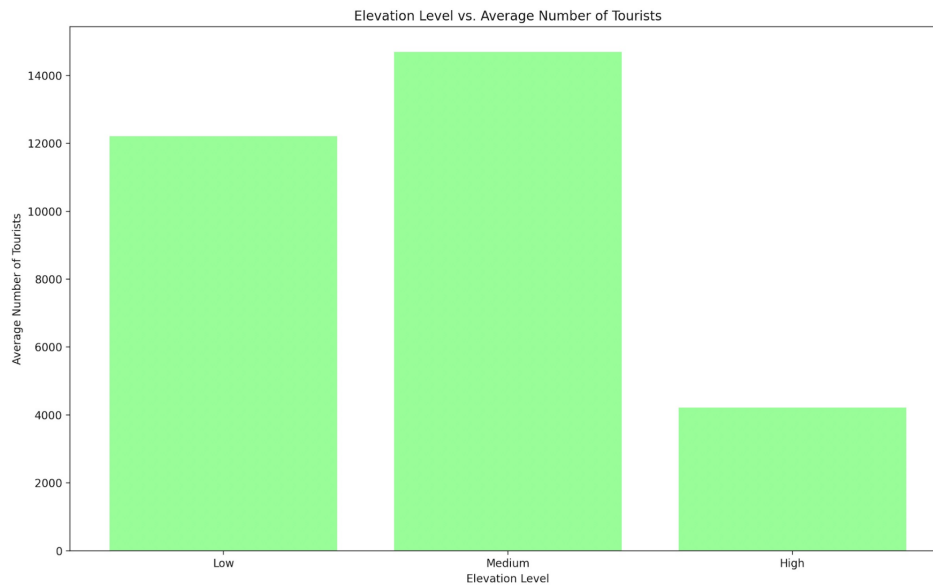
3)



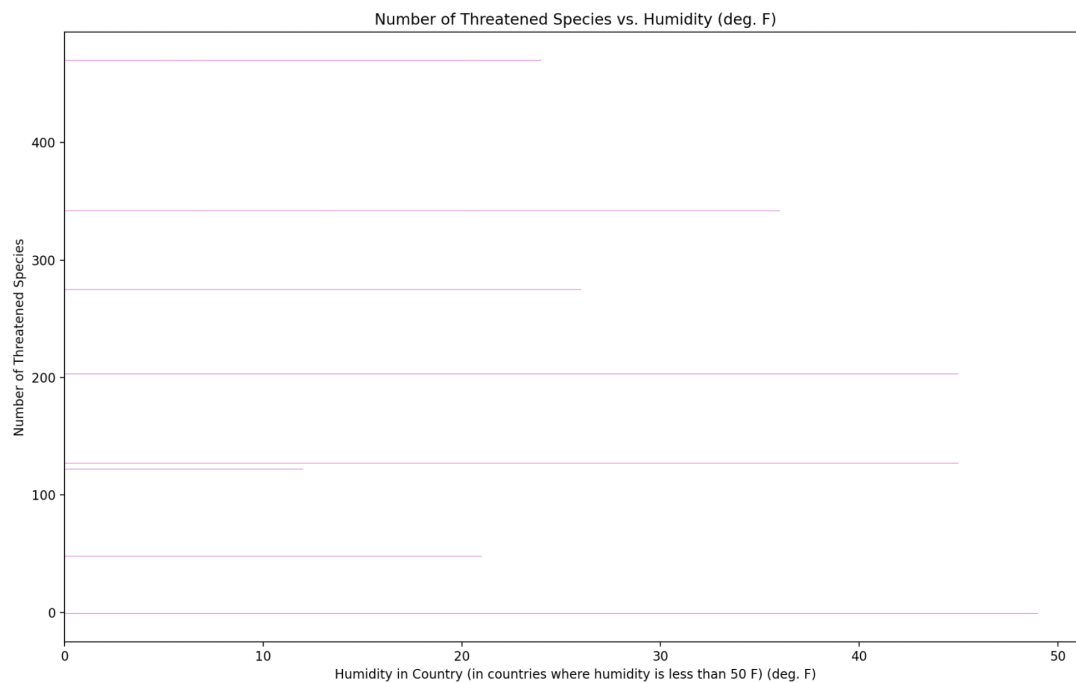
4) AQI quality categories: 0-50 = good, 51-100 = moderate, 101-150 = Unhealthy for some, 151-200 = Unhealthy, 201-300 = Very Unhealthy



#### 4) EXTRA CREDIT VISUALIZATIONS



Elevation categories: low elevation = 0-199, medium elevation: 200-999, high elevation: 1,000+



## 6. Instructions for running your code (10 points)

First, run `air_quality.py` 4 times in order to input the `air_quality` table to the database

- Joined with `country.py` to create `average_tourists_elevation.txt`

Next, run `airport.py` 4 times in order to input the `airport` table to the database

Next, run `locations.py` 4 times in order to create the `airport location` table

Next, run `country.py` 4 times in order to input the `country` table to the database

- Joined with `air_quality.py` to create `average_tourists_elevation.txt`

Next, run `weather.py` 4 times in to input the `weather` tablet to the database

Finally, run `visualizations.py` to see the graphs and visualizations we created

## 7. Documentation for each function that you wrote. This includes describing the input and output for each function (20 points)

### AIR\_QUALITY.PY

#### 1) `def get_data_air_quality(country):`

INPUT: (country)

OUTPUT: A dictionary

PURPOSE: This function takes in data from the `air_quality` API URL and country and converts it into JSON, returning as a dictionary.

#### 2) `def create_air_quality_table(cities, cur, conn):`

INPUT: List of cities, cur, conn

OUTPUT: Creates `air_quality` table in `airports.db`

PURPOSE: To create a table

**3) def main():**

INPUT: None

OUTPUT: None

PURPOSE: To run all the functions

**AIRPORT.PY**

**1) def get\_airport\_data(city):**

INPUT: (city)

OUTPUT: A dictionary

PURPOSE: This function takes in data from the airport API URL and city and converts it into JSON, returning as a dictionary.

**2) def create\_airport\_table(cities, cur, conn):**

INPUT: List of cities, cur, conn

OUTPUT: Creates airport table in airports.db

PURPOSE: To create a table

**3) def main():**

INPUT: None

OUTPUT: None

PURPOSE: To run all the functions

**COUNTRY.PY**

**1) def getdata(country):**

INPUT: (country)

OUTPUT: A dictionary

PURPOSE: This function takes in data from the country API URL and converts it into JSON, returning as a dictionary.

**2) def createtable1(countries1, cur, conn):**

INPUT: List of countries, cur, conn

OUTPUT: Creates country table in airports.db

PURPOSE: To create a table

**3) def main():**

INPUT: None

OUTPUT: None

PURPOSE: To run all the functions

**LOCATION.PY**

**1) def get\_location\_data(city):**

INPUT: (city)

OUTPUT: A dictionary

PURPOSE: This function takes in data from the air\_quality API URL and country and converts it into JSON, returning as a dictionary.

**2) def create\_airport\_loc\_table(cities, cur, conn):**

INPUT: List of cities, cur, conn

OUTPUT: Creates airport location table in airports.db

PURPOSE: To create a table

**3) def main():**

INPUT: None

OUTPUT: None

PURPOSE: To run all the functions

**VISUALIZATIONS.PY**

**1) def avg\_timezones(cur):**

INPUT: (cur)

OUTPUT: A visualization

PURPOSE: To calculate the average number of refugees in each country based on the airport's timezone

**2) def avg\_tourists(cur):**

INPUT: (cur)

OUTPUT: A visualization

PURPOSE: To calculate the average number of tourists (more than 200 per country) vs the average elevation of that country

**3) def avg\_AQI(cur):**

INPUT: (cur)

OUTPUT: A visualization

PURPOSE: To calculate the average population of countries grouped by the AQI category

**4) def ec\_weather(cur):**

INPUT: (cur)

OUTPUT: A visualization

PURPOSE: To calculate the average number of threatened species and the average humidity in a country

**5) def main():**

INPUT: None

OUTPUT: None

PURPOSE: To run all the functions

**WEATHER.PY**

**1) def get\_data\_weather(city):**

INPUT: (city)

OUTPUT: A dictionary

PURPOSE: This function takes in data from the country API URL and converts it into JSON, returning as a dictionary.

**2) def create\_weather\_table(cities, cur, conn):**

INPUT: List of cities, cur, conn

OUTPUT: Creates weather table in airports.db

PURPOSE: To create a table

**3) def main():**

INPUT: None

OUTPUT: None

PURPOSE: To run all the functions



**8. You must also clearly document all resources you used. The documentation should be of the following form (20 points)**

	Date	Issue Description	Location of Resource	Result (did it solve the issue?)
Airport API	04/16/2023	Changed APIs last minute and needed to find new one	API Ninjas <a href="https://api-ninjas.com/">https://api-ninjas.com/</a>	Yes
Weather API	04/16/2023	Changed APIs last minute and needed to find new one	API Ninjas <a href="https://api-ninjas.com/">https://api-ninjas.com/</a>	Yes
Country API	04/16/2023	Changed APIs last minute and needed to find new one	API Ninjas <a href="https://api-ninjas.com/">https://api-ninjas.com/</a>	Yes
Air Quality API	04/16/2023	Changed APIs last minute and needed to find new one	API Ninjas <a href="https://api-ninjas.com/">https://api-ninjas.com/</a>	Yes
Google Sheets Databases	04/16/2023	We needed a way to normalize our data and lay out how we are going to utilize the databases	Google Sheets  Database - Entit...	Yes
Matplotlib	04/16/2023	Needed a way to create the visuals	<a href="https://matplotlib.org/">https://matplotlib.org/</a>	Yes

**Changes made after grading session:**

- All statements that included “drop table” are deleted
- We had duplicate string data in all tables in the form of the name of the cities; to change this, we stored the city name column in only the airport location table and used a city\_ID foreign key in other tables
- Created a new foreign key called country\_ID to serve as a foreign key for the name of the countries in other tables in the database
- Ran weather.py file one more time to get all 100 items in there instead of 75