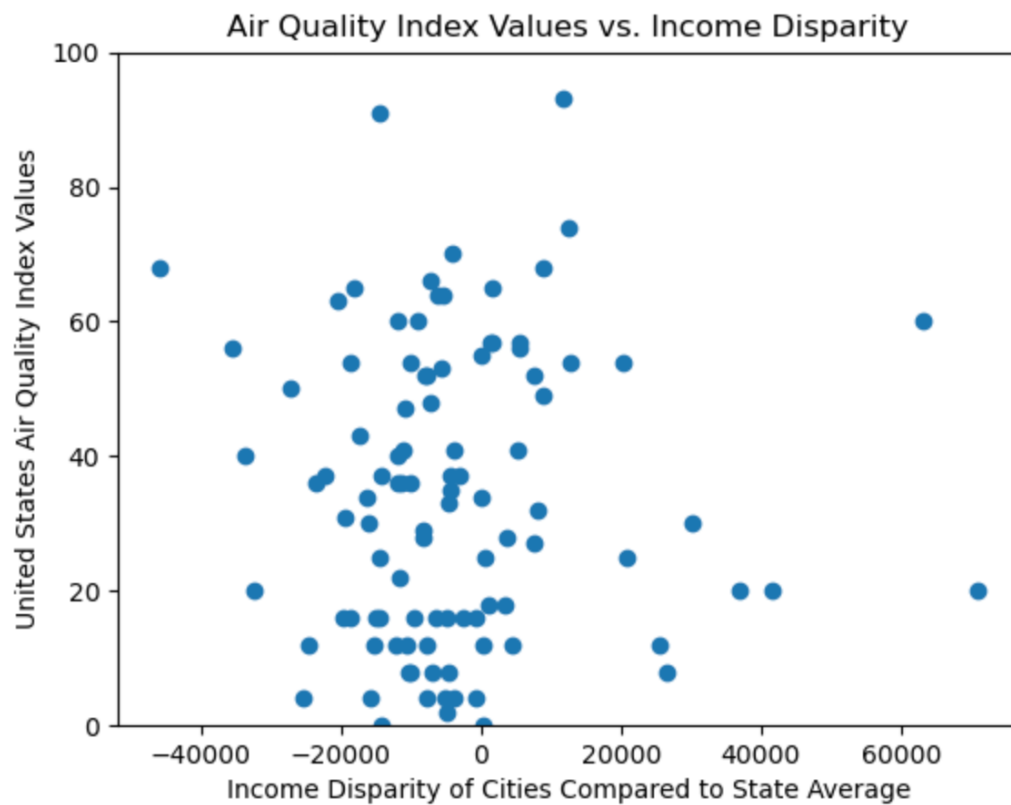


SI 206 Final Project Report

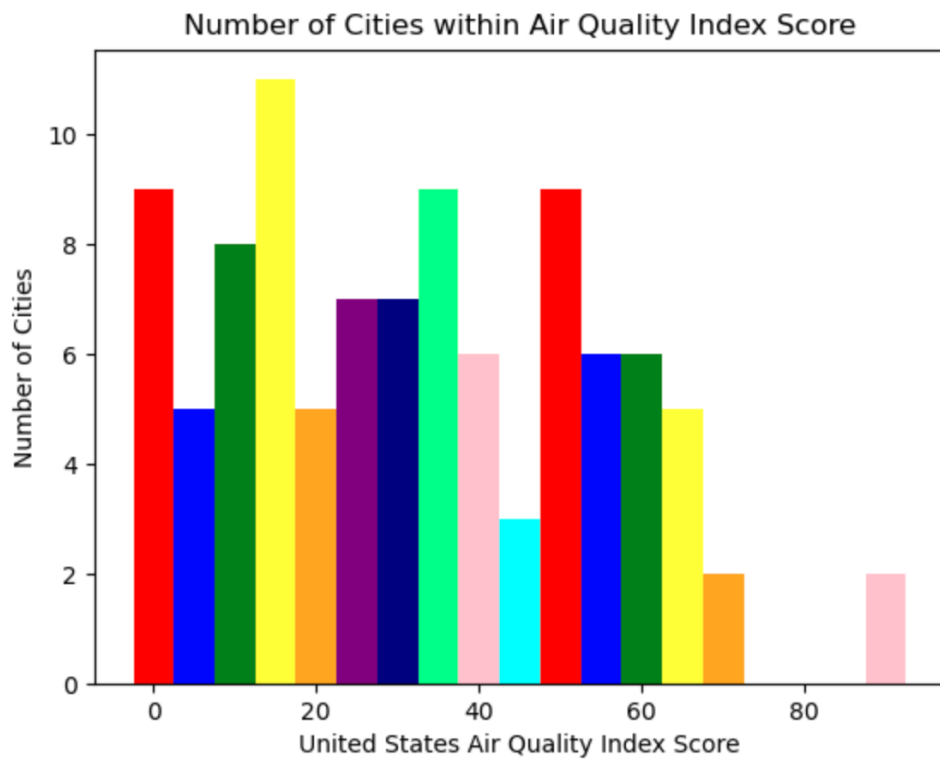
1. For the final project, we planned on gathering income data using the American Community Survey (ACS) API (api.census.gov/data/2021/acs/acs1) as well as shelter data using the Adopt-A-Pet API (api.adoptapet.com). Our goal was to compare the average incomes of local areas with how many pets and of what kind were residing in the local shelter. We were trying to see if there was any meaningful correlation between income and the amount and types of pets people would adopt from a shelter.
2. The APIs we actually worked with were the American Community Survey API mentioned above and the IQAir API (api.airvisual.com/v2) which measures air quality and air pollutants. Our goals were to compare the median income of cities with the average for the state and determine whether there was a correlation between this income disparity and the air quality of the city. The data we ended up gathering was the median incomes for 100 different cities and all 50 states and the District of Columbia as well as air quality data for those 100 cities. We achieved our goal through our data calculations and visualizations.
3. We ran into problems almost immediately by not being able to generate an API key for the Adopt-A-Pet API. We spent a good amount of time attempting to do so before we realized that the API was deprecated, so we decided to move on and focus on air quality instead of shelter animals. We also faced problems involving the documentation of the ACS API. It was quite challenging to find the specific codes needed to retrieve data related to specific places, but we managed to find the codes eventually.

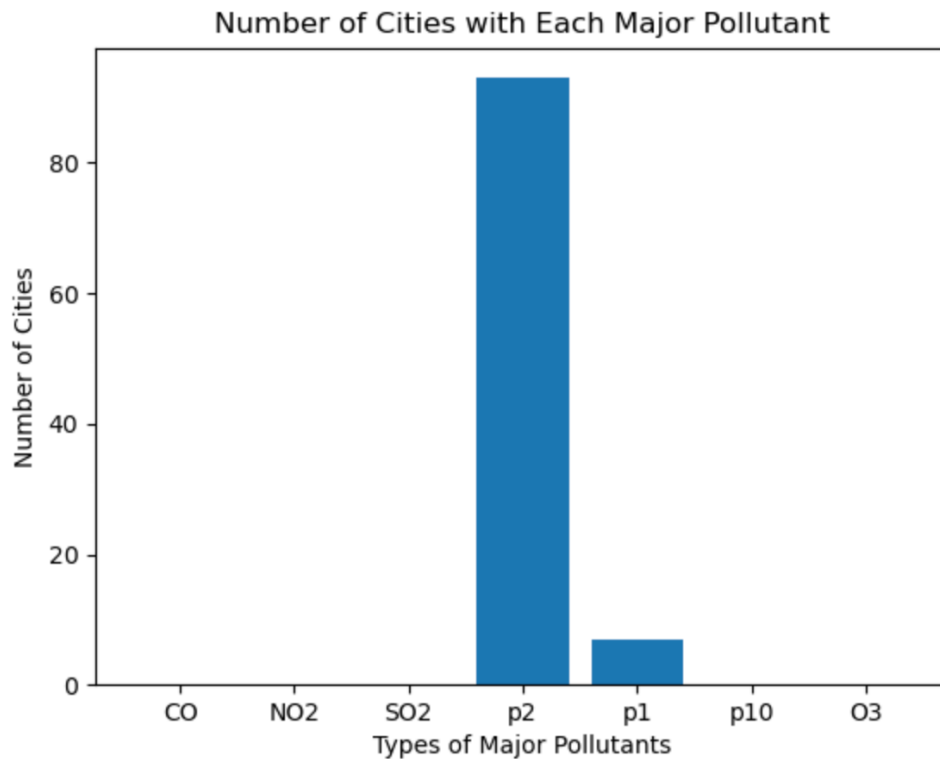
4.

```
# pollution_and_income_calculations.txt
1 The income disparity for the city of Birmingham is -17299 when compared to the state average of 53913
2 The income disparity for the city of Mobile is -18127 when compared to the state average of 53913
3 The income disparity for the city of Anchorage is 8889 when compared to the state average of 77845
4 The income disparity for the city of Phoenix is -621 when compared to the state average of 69056
5 The income disparity for the city of Tucson is -18758 when compared to the state average of 69056
6 The income disparity for the city of Mesa is 218 when compared to the state average of 69056
7 The income disparity for the city of Chandler is 25557 when compared to the state average of 69056
8 The income disparity for the city of Scottsdale is 38041 when compared to the state average of 69056
9 The income disparity for the city of Los Angeles is -14535 when compared to the state average of 84907
10 The income disparity for the city of San Diego is 9135 when compared to the state average of 84907
11 The income disparity for the city of San Jose is 41478 when compared to the state average of 84907
12 The income disparity for the city of San Francisco is 36919 when compared to the state average of 84907
13 The income disparity for the city of Fresno is -23657 when compared to the state average of 84907
14 The income disparity for the city of Sacramento is -4556 when compared to the state average of 84907
15 The income disparity for the city of Long Beach is -11802 when compared to the state average of 84907
16 The income disparity for the city of Oakland is -2671 when compared to the state average of 84907
17 The income disparity for the city of Santa Ana is -4642 when compared to the state average of 84907
18 The income disparity for the city of Anaheim is -3108 when compared to the state average of 84907
19 The income disparity for the city of Riverside is -4349 when compared to the state average of 84907
20 The income disparity for the city of Stockton is -15863 when compared to the state average of 84907
21 The income disparity for the city of Fremont is 71861 when compared to the state average of 84907
22 The income disparity for the city of Irvine is 28807 when compared to the state average of 84907
23 The income disparity for the city of San Bernardino is -19596 when compared to the state average of 84907
24 The income disparity for the city of Modesto is -14438 when compared to the state average of 84907
25 The income disparity for the city of Denver is -624 when compared to the state average of 82254
26 The income disparity for the city of Colorado Springs is -1671 when compared to the state average of 82254
27 The income disparity for the city of Aurora is -18697 when compared to the state average of 82254
28 The income disparity for the city of Washington is 0 when compared to the state average of 90888
29 The income disparity for the city of Jacksonville is -4441 when compared to the state average of 63862
30 The income disparity for the city of Miami is -14272 when compared to the state average of 63862
31 The income disparity for the city of Tampa is 342 when compared to the state average of 63862
32 The income disparity for the city of Hialeah is -16388 when compared to the state average of 63862
33 The income disparity for the city of Atlanta is 7548 when compared to the state average of 66559
34 The income disparity for the city of Augusta is -18038 when compared to the state average of 66559
35 The income disparity for the city of Boise is 3743 when compared to the state average of 66474
36 The income disparity for the city of Chicago is -5629 when compared to the state average of 72285
37 The income disparity for the city of Indianapolis is -4264 when compared to the state average of 62743
38 The income disparity for the city of Fort Wayne is -4886 when compared to the state average of 62743
39 The income disparity for the city of Des Moines is -4987 when compared to the state average of 65688
40 The income disparity for the city of Wichita is -7831 when compared to the state average of 64124
41 The income disparity for the city of Louisville is 1089 when compared to the state average of 53573
42 The income disparity for the city of Lexington is 5369 when compared to the state average of 53573
43 The income disparity for the city of New Orleans is -5145 when compared to the state average of 52887
44 The income disparity for the city of Shreveport is -10853 when compared to the state average of 52887
45 The income disparity for the city of Baltimore is -35551 when compared to the state average of 50283
46 The income disparity for the city of Boston is -18150 when compared to the state average of 80645
47 The income disparity for the city of Boston is -18362 when compared to the state average of 80645
48 The income disparity for the city of Detroit is -27358 when compared to the state average of 63498
49 The income disparity for the city of Ann Arbor is 5366 when compared to the state average of 63498
50 The income disparity for the city of Grand Rapids is -3982 when compared to the state average of 63498
51 The income disparity for the city of Minneapolis is -8323 when compared to the state average of 77728
52 The income disparity for the city of Saint Paul is -11622 when compared to the state average of 77728
53 The income disparity for the city of Kansas City is 1549 when compared to the state average of 61847
54 The income disparity for the city of St. Louis is -11882 when compared to the state average of 61847
55 The income disparity for the city of Omaha is -3869 when compared to the state average of 66817
56 The income disparity for the city of Lincoln is -4523 when compared to the state average of 66817
57 The income disparity for the city of Las Vegas is -6528 when compared to the state average of 66274
58 The income disparity for the city of Henderson is 11658 when compared to the state average of 66274
59 The income disparity for the city of Reno is 3284 when compared to the state average of 66274
60 The income disparity for the city of Newark is -46854 when compared to the state average of 89296
61 The income disparity for the city of Jersey City is -7338 when compared to the state average of 89296
62 The income disparity for the city of Albuquerque is 4528 when compared to the state average of 53992
63 The income disparity for the city of New York City is -6317 when compared to the state average of 74314
64 The income disparity for the city of Buffalo is -33645 when compared to the state average of 74314
65 The income disparity for the city of Rochester is -32334 when compared to the state average of 74314
66 The income disparity for the city of Albany is -24551 when compared to the state average of 74314
67 The income disparity for the city of Charlotte is 8899 when compared to the state average of 61972
68 The income disparity for the city of Raleigh is 12648 when compared to the state average of 61972
69 The income disparity for the city of Greensboro is -18147 when compared to the state average of 61972
70 The income disparity for the city of Winston-Salem is -7744 when compared to the state average of 61972
71 The income disparity for the city of Columbus is -4866 when compared to the state average of 62262
72 The income disparity for the city of Cincinnati is -18529 when compared to the state average of 62262
73 The income disparity for the city of Toledo is -18112 when compared to the state average of 62262
74 The income disparity for the city of Oklahoma City is 3388 when compared to the state average of 55826
75 The income disparity for the city of Tulsa is -4818 when compared to the state average of 55826
76 The income disparity for the city of Portland is 7465 when compared to the state average of 68957
77 The income disparity for the city of Philadelphia is -16858 when compared to the state average of 68957
78 The income disparity for the city of Pittsburgh is -11136 when compared to the state average of 68957
79 The income disparity for the city of Columbia is -11794 when compared to the state average of 59118
80 The income disparity for the city of Nashville is 3162 when compared to the state average of 59663
81 The income disparity for the city of Memphis is -15378 when compared to the state average of 59663
82 The income disparity for the city of Houston is -11464 when compared to the state average of 66963
83 The income disparity for the city of San Antonio is -12848 when compared to the state average of 66963
84 The income disparity for the city of Dallas is -4988 when compared to the state average of 66963
85 The income disparity for the city of Austin is 12579 when compared to the state average of 66963
86 The income disparity for the city of Fort Worth is 1272 when compared to the state average of 66963
87 The income disparity for the city of El Paso is -15722 when compared to the state average of 66963
88 The income disparity for the city of Corpus Christi is -7151 when compared to the state average of 66963
89 The income disparity for the city of Lubbock is -12216 when compared to the state average of 66963
90 The income disparity for the city of Laredo is -14525 when compared to the state average of 66963
91 The income disparity for the city of Frisco is 63155 when compared to the state average of 66963
92 The income disparity for the city of Garland is -5356 when compared to the state average of 66963
93 The income disparity for the city of Virginia Beach is 671 when compared to the state average of 80963
94 The income disparity for the city of Alexandria is 20199 when compared to the state average of 80963
95 The income disparity for the city of Norfolk is -22372 when compared to the state average of 80963
96 The income disparity for the city of Seattle is 26534 when compared to the state average of 84247
97 The income disparity for the city of Spokane is -25533 when compared to the state average of 84247
98 The income disparity for the city of Everett is -14224 when compared to the state average of 84247
99 The income disparity for the city of Tacoma is -7106 when compared to the state average of 84247
100 The income disparity for the city of Milwaukee is -20488 when compared to the state average of 67125
101 The income disparity for the city of Madison is 145 when compared to the state average of 67125
102 There are 93 cities with p2 as their main pollutant
103 The average air quality for cities with p2 as their main pollutant is 34.18279569892473
104 There are 7 cities with p1 as their main pollutant
105 The average air quality for cities with p1 as their main pollutant is 33.857142857142854
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5.





6. To run our code properly, first the user needs to populate the database. This can be done by running main four times, which in turn calls the correct functions from populate_database.py and inserts 25 items into each table per execution, totaling 100 entries in the table after four executions. After populating the database, the user needs to run calculations_and_visualizations.py which retrieves the necessary data from the database, performs calculations on the data, and writes the results to a file named pollution_and_income_calculations.txt. Finally, calculations_and_visualizations uses the calculated data to create three visualizations which it saves with file names num_city_pollutants.png, avg_aqis_for_pollutants.png, and air_quality_vs_income.png.

7.

Function Name	Inputs	Outputs	Description
Main in main.py	None	None	stores Census and IQAIR api keys. Sets up a database and populates tables by calling populate functions
set_up_database	db_name: The name of the database	conn: The database connection cur: the connection cursor	Creates a database based on the database name and defines three tables, cities, states, and iqair

populate_iqair_and_cities_database	conn: The database connection cur: The connection cursor iqair_api_key: The IQAir API key census_api_key: The ACS api key	None	Store a list of dictionaries with the name, state, place FIPS, and state FIPS of 100 popular and diverse US cities. The dictionary values will be used to handle requests to the IQAIR and US Census APIs. A range for loop in conjunction with getting the number of data already in the iqair table will be used to input only 25 elements into each table.
populate_states_database	conn: The database connection cur: The connection cursor census_api_key: The ACS api key	None	Store a list of dictionaries with the name and state FIPS code of 50 US states. The dictionary values will be used to handle requests to the US Census API. A range for loop in conjunction with getting the number of data already in the states table will be used to input only 25 elements into the states table.
get_request_iqair	url: the url from which to request api_key: the specific api key to use for the request	The API response in JSON format	handles request to IQAIR API and provides error message if unsuccessful
get_request_MHI_city_census	place: a valid city FIPS code state: A valid state FIPS code api_key: the specific api key to use for the request	The API response in JSON format or None	Handle request to US Census ACS API with provided place (city FIPS code) and state (state FIPS code). The function will provide error message if unsuccessful.
get_request_MHI_state_census	state: A valid state FIPS code api_key: the specific api key to use for the request	The API response in JSON format or None	Handle request to US Census ACS API with provided state (state FIPS code). The function will provide error message if unsuccessful.

main in calculation s_and_visualizations.py	None	None	Connects to the database and opens a file for writing before calling helper functions that make calculations and visualizations using the database data and write to the file.
calculate_disparity	cur: The connection cursor f: The file handle	Income_disparity: A list of dictionaries with each dictionary having a key for city_name, state_name, city_median_income, state_median_income, and income_disparity	Retrieves data from the cities and states table joined on statefp then uses the data to construct the income_disparity list of dictionaries while printing out each cities data
calculate_pollution_factors	cur: The connection cursor f: The file handle	pollution_factors: A dictionary of the total main pollutants in the cities aqi_scores:The sum of all aqi scores for cities with each major pollutant city_aqi_scores: A dictionary of aqi scores for each city	Reads data from the iqair table and parses through the data to construct the output dictionaries. While it constructs the dictionaries it outputs the calculated data to the inputted file handle
visualize_data	Income_disparity: A list of dictionaries with each dictionary having a key for city_name, state_name, city_median_income, state_median_income, and income_disparity	None	Uses the passed in data to create three visualizations. One being a barchart of which pollutants are the main polluters of cities. The second being a barchart of AQI scores for the cities. And the third being a scatterplot of AQI scores and income disparity.

	<p>pollution_factors: A dictionary of the total main pollutants in the cities</p> <p>aqi_scores: The sum of all aqi scores for cities with each major pollutant</p> <p>city_aqi_scores: A dictionary of aqi scores for each city</p>		
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8.

Date	Issue Description	Location of Resource	Result (did it solve the issue)
4/17	Unable to obtain an API key from the Adopt-A-Pet API and needed to look for a working API	https://github.com/public-apis/public-apis	Yes found the IQAIR API
4/18	Issue finding the correct census API url format to get median household income from cities and states	<p>Get code for median household income: https://api.census.gov/data/2021/acs/acs1/variables.html</p> <p>Get format for cities and states: https://api.census.gov/data/2021/acs/acs1/examples.html</p>	Yes was able to find the correct code and format
4/19	The census API url format required the FIPS code to make a valid request, so we need a way to get the FIPS place and state code for our 100 cities	https://www.census.gov/library/reference/code-lists/ansi.html	Was able to look for cities' FIPS code by state
4/18	We needed to generate 100 unique and diverse cities from around the US	https://openai.com/blog/chatgpt	Yes
4/20	We needed to double check if our cities were supported by the IQAIR API	https://api-docs.iqair.com/	Yes it was able to provide us with the url format to request supported

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Github repo: https://github.com/mytdao/SI206_final.git

			cities based on the state we give it
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