

Project: Learn to use a Spatial Database (SDBMS) and GIS visualization tools

Introduction:

In this project students will be given a dataset which consist of a road map (Lines), counties map (Polygons), WAZE application events dataset (Points). The WAZE database is a collection of traffic events such as delays, accidents, traffic jams, etc. The datasets are of shapefile (.shp) format and will focus on the Texas counties in the Dallas/Fort Worth/Arlington area. The students can load the data into any spatial database management system (SDBMS) like SpatiaLite, PostGIS, etc.

Once the data has been uploaded to a SDBMS then they can use a GIS software (QGIS, ArcGIS, etc) to visualize the data. They will have to apply graphical interface on this project. Using the graphical interface, the students should be able to display (visualize) the results of various queries such as:

1. Show the different objects or locations,
2. Find region with most traffic jam,
3. Compute the area of an object, etc.

All the computation should be done within the SDBMS. The GIS program should just be used to visualize the output. The purposes of this project would be for the students to:

1. Learn how to load shapefile to SDBMS,
2. Use the spatial functions to answer queries,
3. Use GIS visualization tools to display the result.

First milestone:

In the first part, students will load the shapefile to SDBMS tables and create indexes on each table. ***Then, you should answer the provided queries (page 10).***

Each set of queries belongs to different categories: 1) non-spatial: can be answered without spatial function. 2) spatial and spatio-temporal queries: must be answered with spatial function.

Instruction for this milestone: Write a report that includes:

- 1- First page includes the students and the course information.
- 2- Provide proof of loading the data to SDBMS and describe how you loaded the data. Also show screenshot of the tables showing the first 10 rows in each table.

- 3- Analysis of the given dataset. Provide documentation to show that you studied each table and understand what kind of attributes and information exists in each table.
- 4- Make a list of the spatial functions available in the Spatial DBMS to answer queries in category (2) (Spatial and spatio-temporal queries)
- 5- Provide the result to each query in the requested format. Also provide the SQL statement for each query.

The due date for milestone 1: Friday April 8,2022 11:59 pm.

The report will be submitted through Canvas.

Second milestone:

In the second part, students will use GIS visualization tools (i.e. QGIS) to display the maps of different areas and show the results of the provided queries. *You must write the steps to answer each question and display the result as in the following example.*

The first due date: April 15, 2022 11:59 pm.

Only need to submit the answer of two queries.

The second due date: Thursday April 29, 2022 11:59 PM

Include the answer to all queries in this milestone.

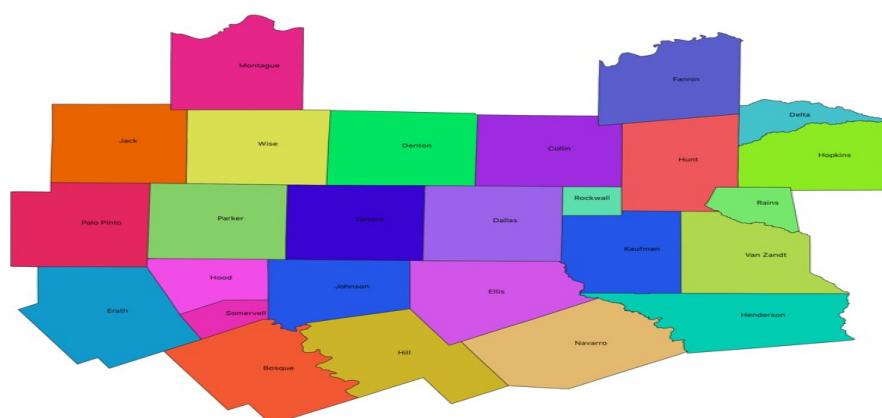
The project will be submitted through Canvas.

Example: Display each county in different colors and the name of each county.

Steps:

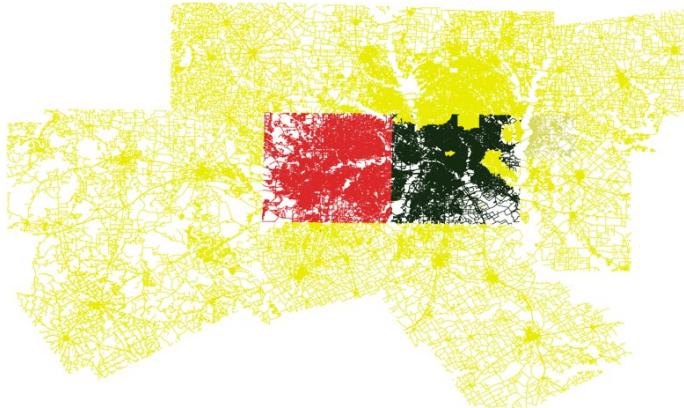
- 1- Add County layer as shapefile in QGIS.
- 2- Write click on the County layer then Properties.
- 3- Choose Symbology → Categorized → Value: CNTY_NM.
- 4- Click Classify. Then apply to see the result.
- 5- For adding the county name: Properties → Labels → value: CNTY_NM

Output:

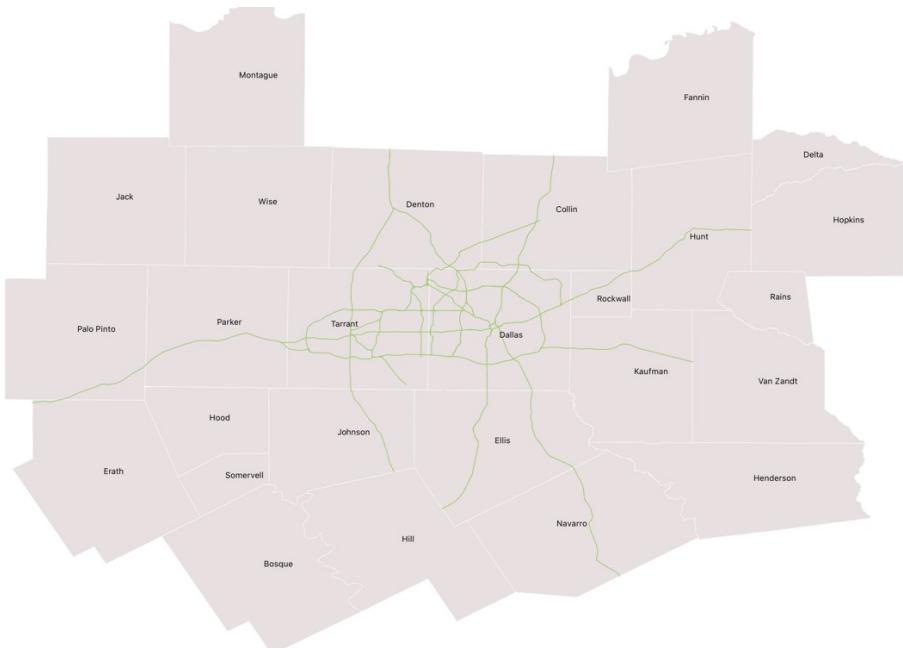


Questions and queries for the second milestone:

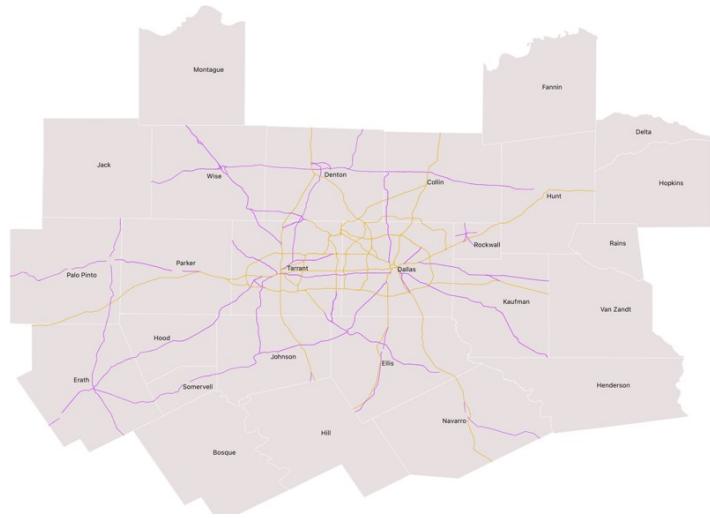
- 1- Display the roads that are located in Collin county in Red color and in Tarrant county in Black color and in Dallas County in Blue color. The rest of the counties, display the roads in Yellow color. The example below shows Tarrant roads in red and Dallas roads in black – your query is slightly different.



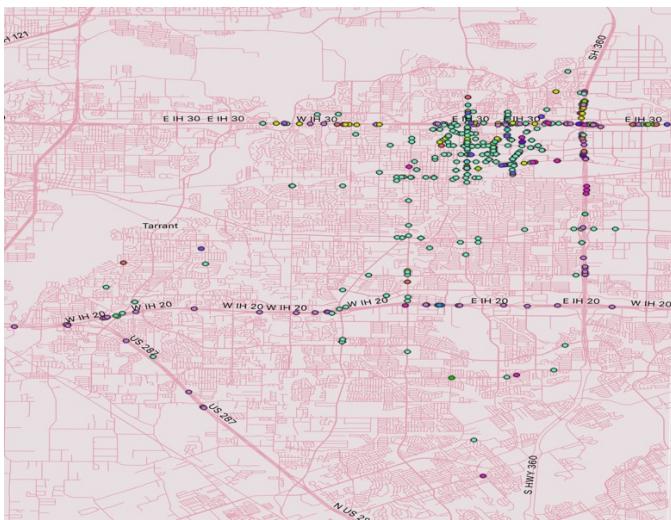
- 2- Display the roads that are in the class: ‘PRIMARY HIGHWAY’ in black with the county in the background. Here they are shown in green.



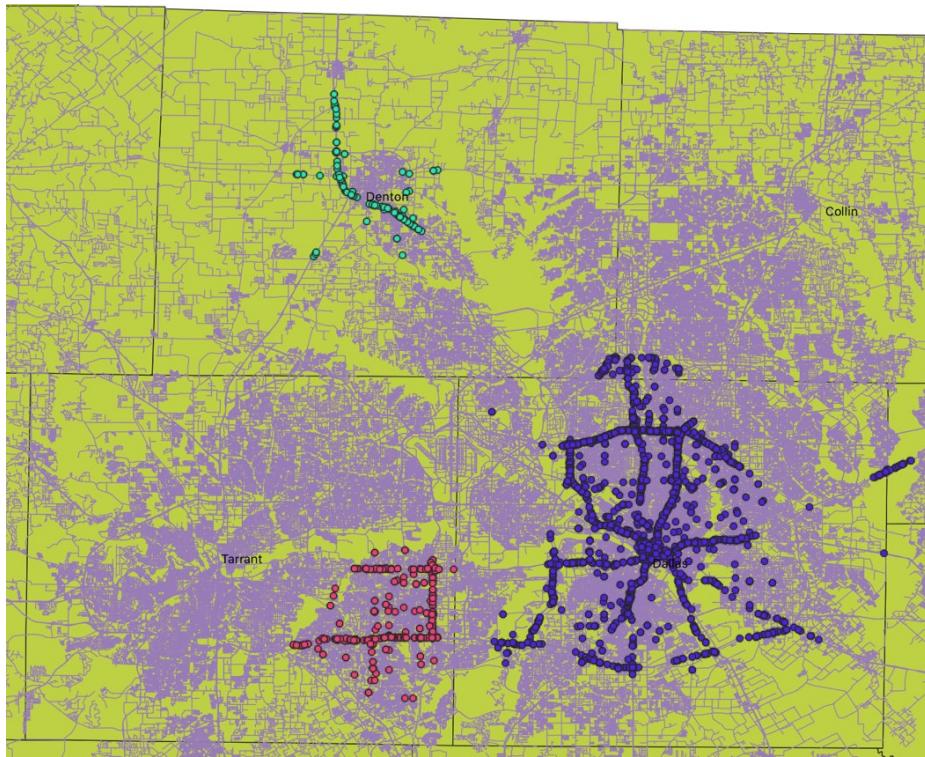
- 3- Display the roads only with class ‘PRIMARY HIGHWAY’ and class ‘SECONDARY HIGHWAY’. Each class should be in a different color with the county in the background.



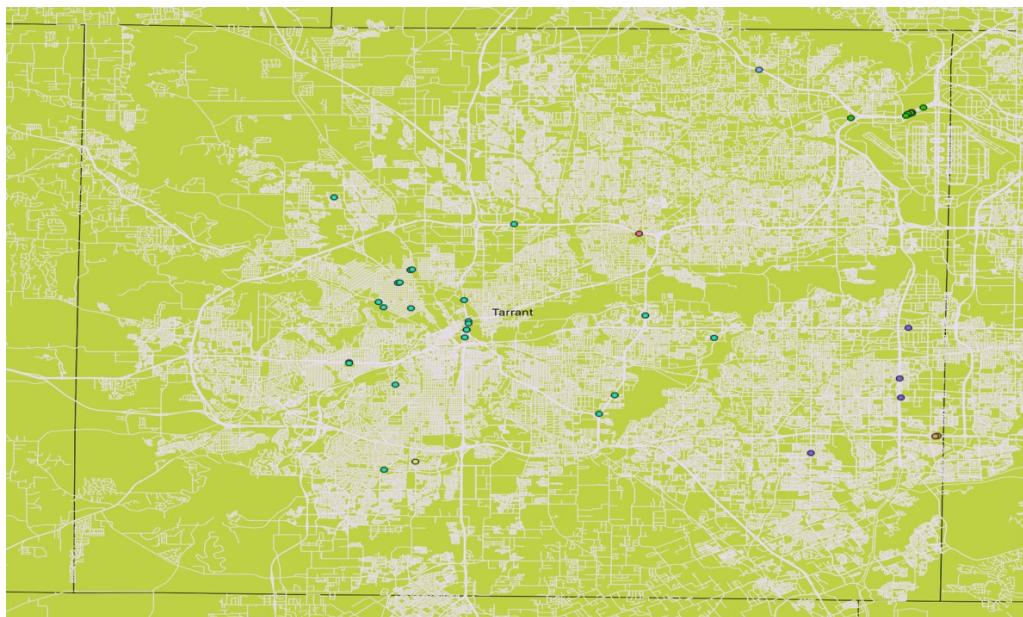
- 4- Display all the events (From DFW_WAZE) that happened in Arlington form 6 am to 12 pm on 12/1/2018. Each event should be displayed with different color and the background should be the roads.



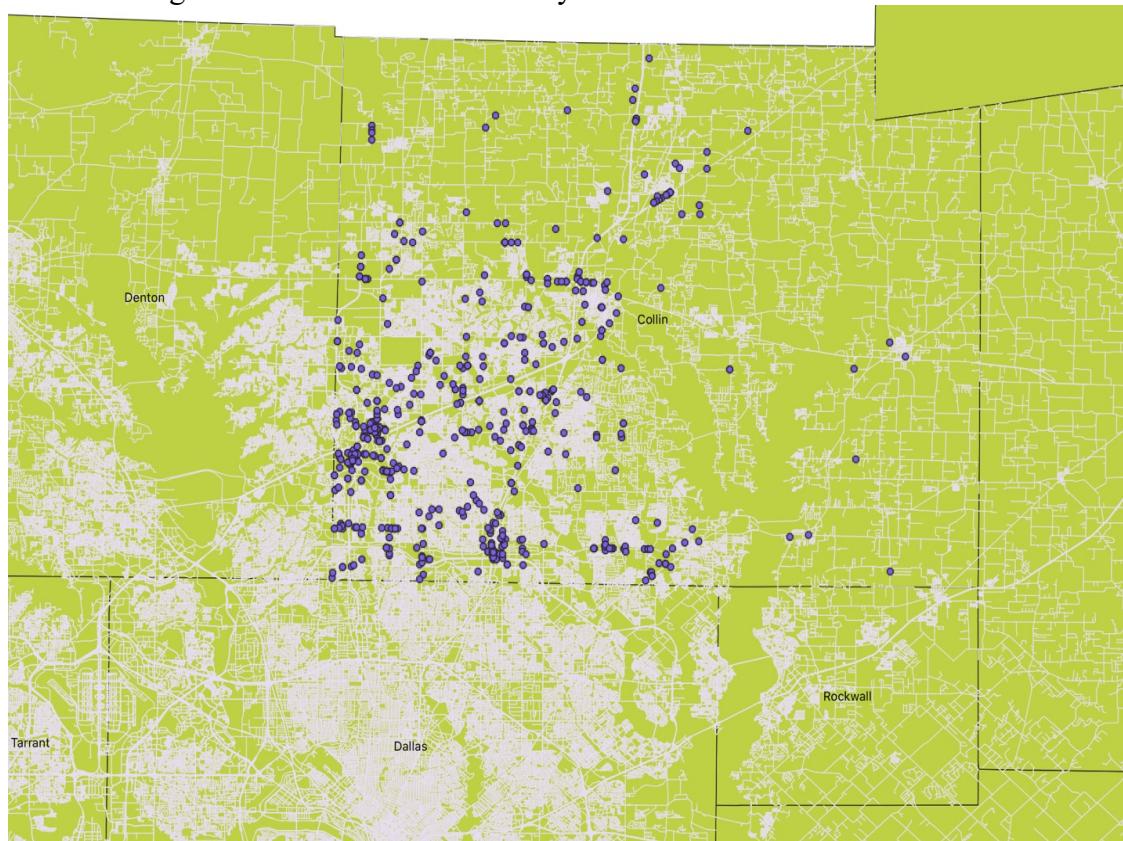
- 5- Display the accidents that happened in Arlington, Dallas, Denton. Each city event in a different color and the background is the roads and county.



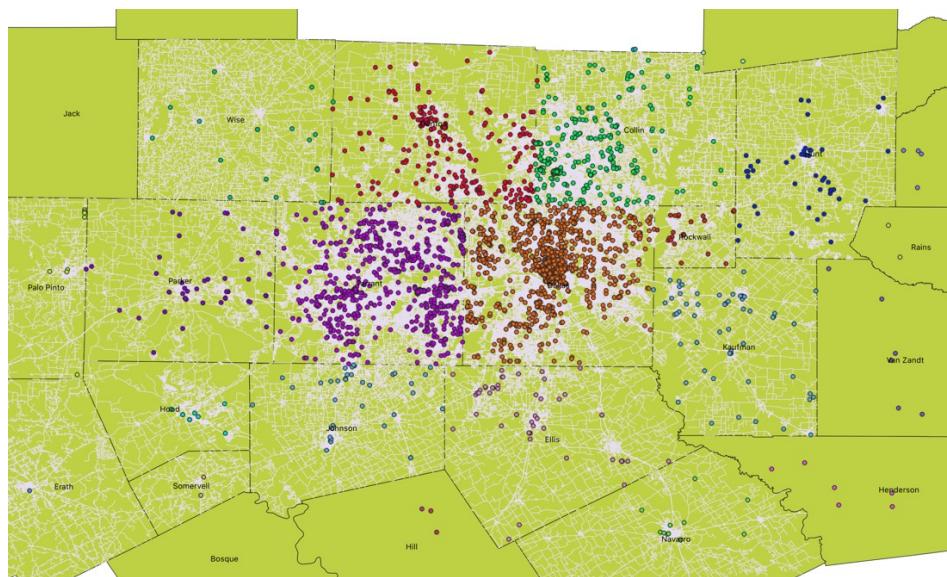
- 6- Display the event type “accident” that happened in Tarrant county on 12/09/2018 between 6:00 and 19:00 where each city accidents are displayed with different color. Roads and counties need to be in the background.



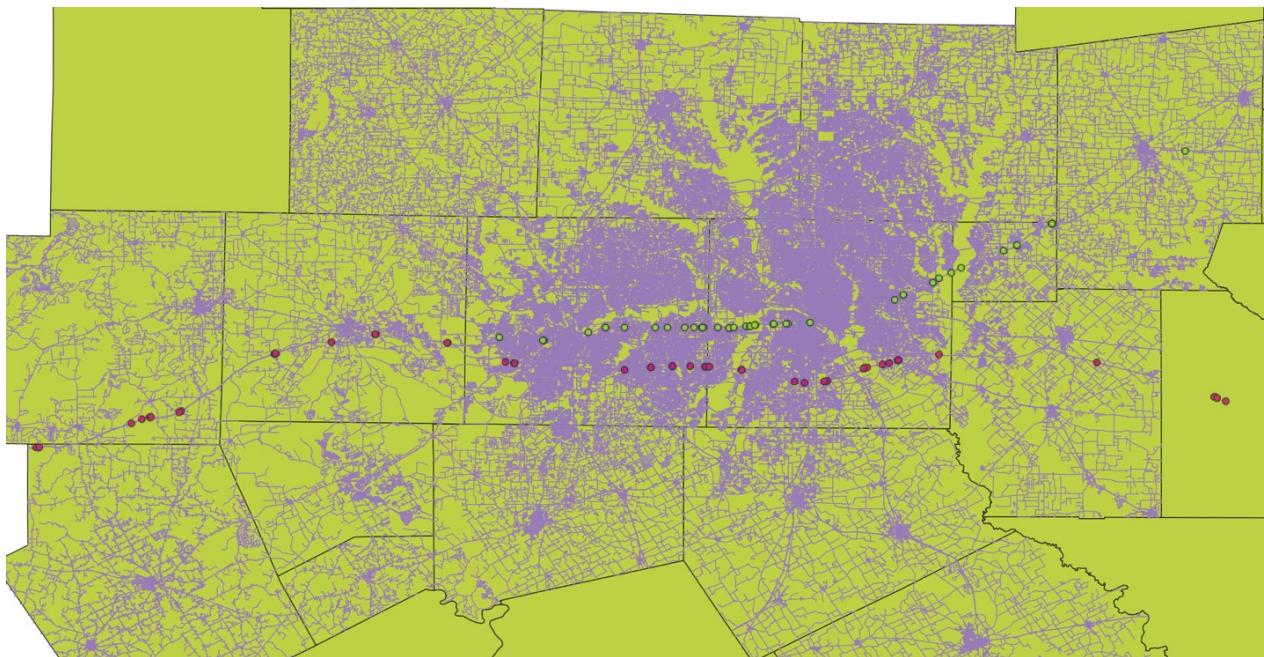
- 7- Display the “traffic jam” in Collin county on 12/27/2018 between 7:00:00 and 15:00:00 and the background is the roads with county.



- 8- For each county, display the event type ‘traffic jam’ on 12/24/2018. Each county with different color.



- 9- Display all the events on the road 'I-20 E' and 'I-30 E' on 12/9/2018 from 9 am to 12 pm.
Events on 'I-20 E' should be in different color than event in 'I-30 E'.



Submit your assignment in CANVAS any time before midnight of the due date. You should follow the instructions on how to turn in your project (One Zipped folder containing all files together). If you are doing the projects in a team of two, ***both team members should submit the project.***
Clearly specify your name and team member's name in the documentation of this project.

File name: Last_name_last4digit_No.zip

Example: one student project:

Shaito_6038_1.zip

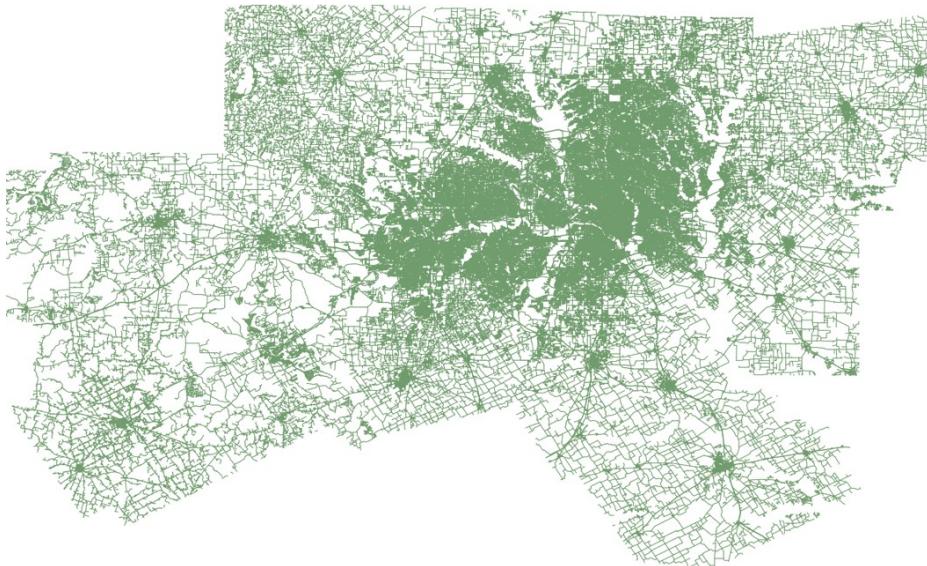
or two students project:

Shaito_6038_Alsahfi_5382_2.zip

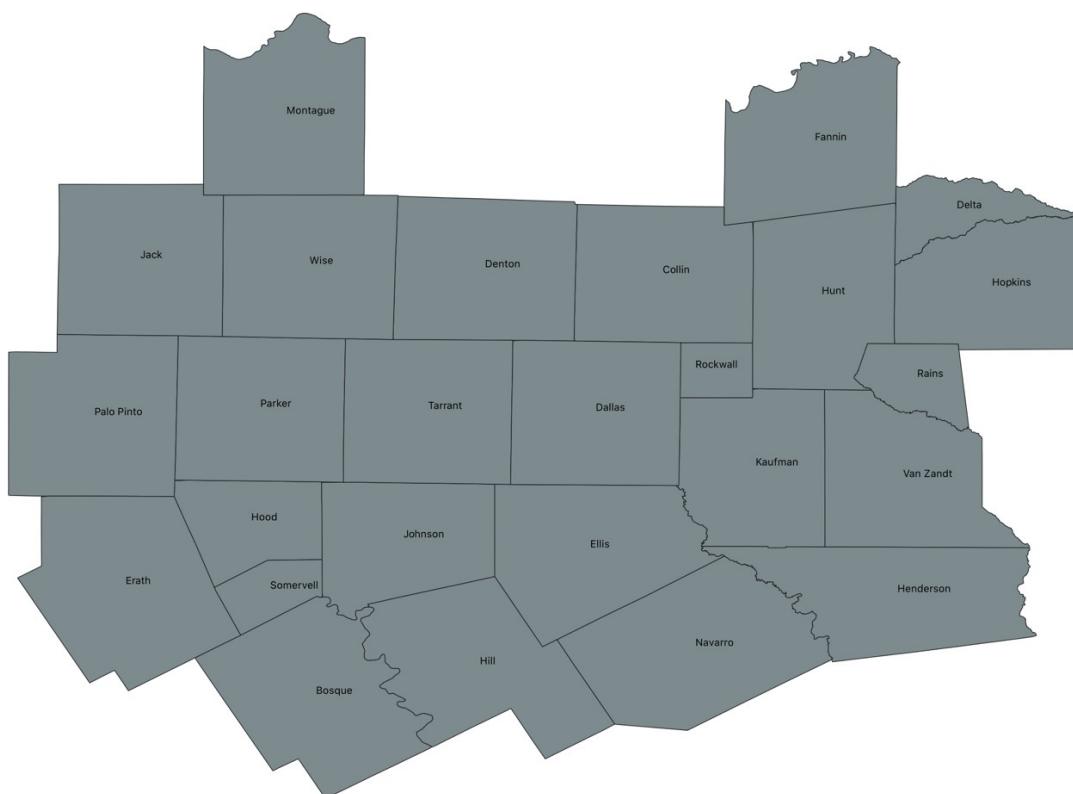
Students are required to not share any of the project related documents and solution with others in any way or form even after the completion of the project. Students may, however, show their projects to interviewers.

Data visualization examples:

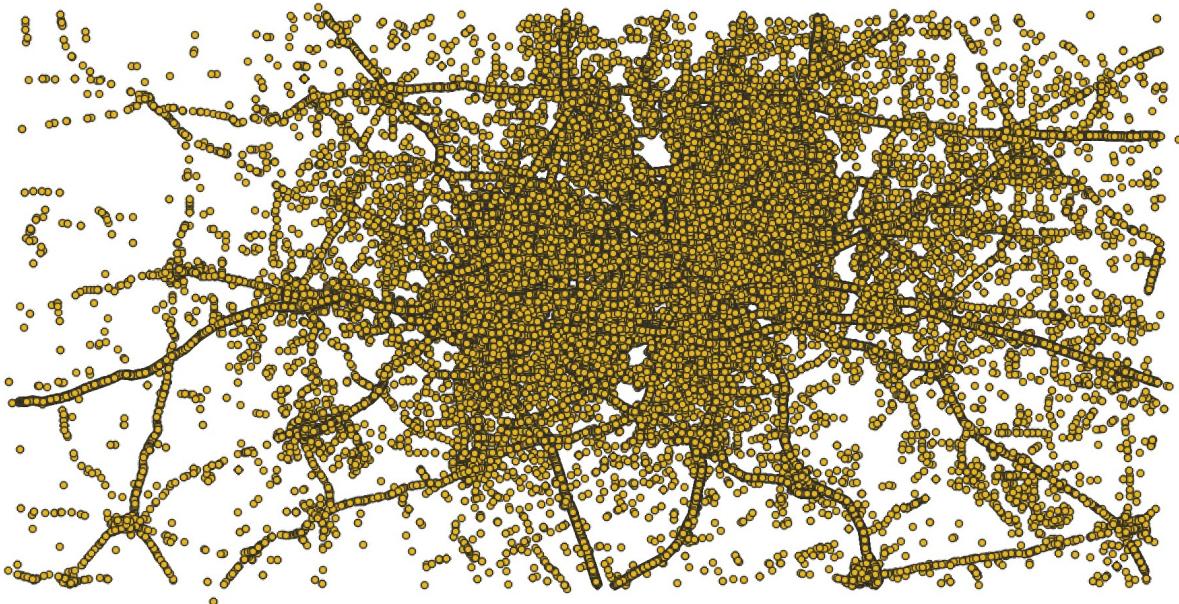
Roads:



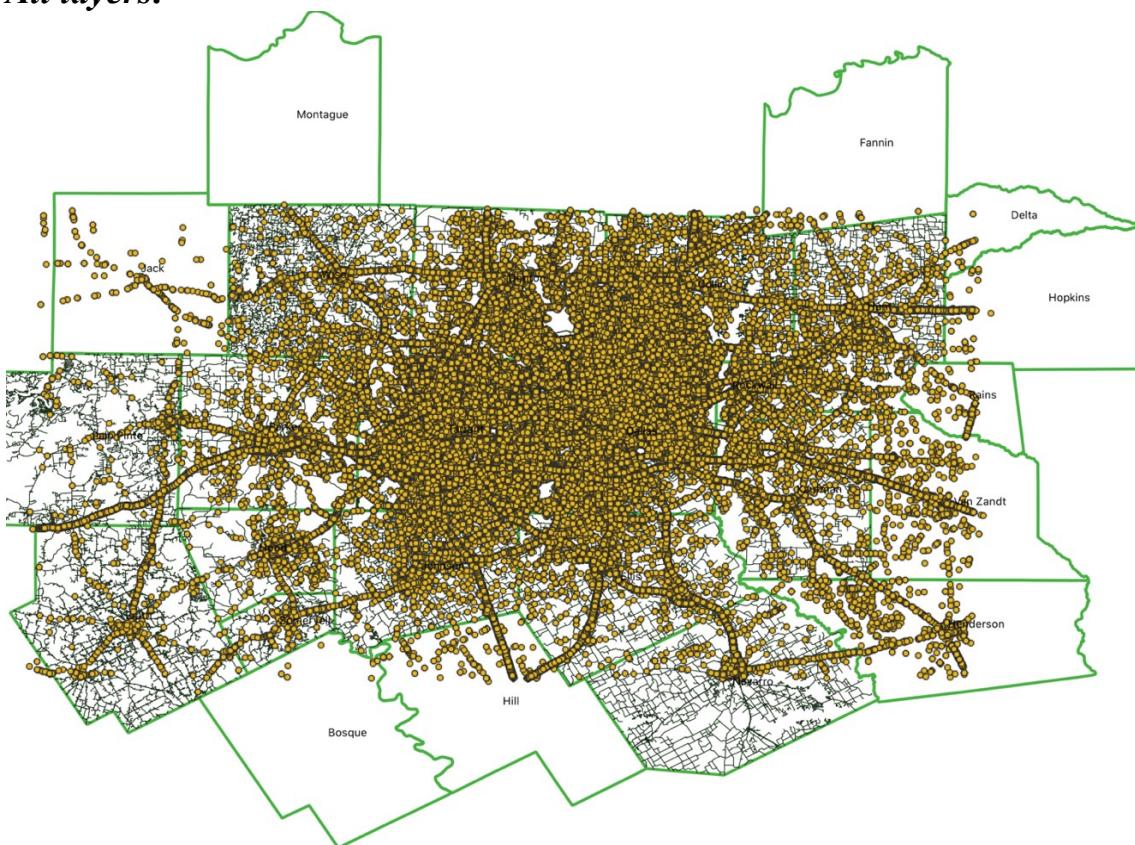
County



WAZE_DFW:



All layers:



Project Queries for milestone 1

*(The answer format)

Queries of category spatial and spatio-temporal must be answered using spatial functions.

Query category: Spatial

- 1- (Number) What is the total area of Tarrant county?
- 2- (List of counties -Text) Which counties are located around Dallas county (share a boundary with Dallas county)?
- 3- (Number) What is the total length of MATLOCK RD that is located in Tarrant county?
- 4- Return the list of all roads that are totally inside Tarrant county boundary.

Note: some roads has more than one record, you need to do group by to return each road name only once.

- 5- (XY coordinate) Return the co-ordinates of the center point of Dallas county as text.
- 6- (Number) Returns the dimension of the geometric object of Hood county?
- 7- (List of roads) Return the names of the roads with class ‘PRIMARY HIGHWAY’ in Tarrant county.
- 8- (List) Return all the roads that intersect with ‘S COOPER ST’ in Arlington
- 9- (County name and size) Return the name of the largest county in size?

Query category: Spatio-temporal

- 1- (streets name) Return the street name and location of event with event type “accident” that happened in Tarrant county on 12/09/2018 between 6:00 and 19:00?
- 2- (Number) Retrieve the number of traffic jams in Collin county on 12/27/2018 between 7:00:00 and 15:00:00.

Query category: Non-spatial

- 1- (list) List the unique event types from WAZE data set.
- 2- (bar chart- only the result from the 2nd row to the 6th row) Return the WAZE event type and total of each type that happened in Arlington on 12/08/2018 order from the largest.
- 3- (bar chart – only the result from the 1st row to the 3rd row) Return the WAZE event type and total of each type that happened in Dallas on 12/25/2018 between 10:00:00 and 12:00:00 order from the largest.
- 4- (Table with event type and total) Retrieve total of each WAZE events that happened on the third Sunday in Dallas city.

Important links:

1- SpatiaLite Cookbook:

<http://www.gaia-gis.it/gaia-sins/spatialite-cookbook/index.html> 2-

What is Shapefile:

<http://www.gaia-gis.it/gaia-sins/spatialite-cookbook/html/shapefile.html>

3- How to create an index:

<http://www.gaia-gis.it/gaia-sins/spatialite-cookbook/html/rtree.html>

4- What is SpatiaLite:

<http://www.gaia-gis.it/gaia-sins/spatialite-cookbook/html/tech-intro.html>

5- Install SpatiaLite:

<https://www.gaia-gis.it/fossil/libspatialite/index>

6- Download QGIS:

<https://qgis.org/en/site/forusers/download.html>

7-

<https://www.gaia-gis.it/spatialite-2.1/SpatiaLite-manual.html>