

# CS 3380 Lab Assignment 9

**Directions :** This assignment is due on **Tuesday, November 11 at 11:59 PM**. You must submit your SQL file through Blackboard prior to the deadline in order to receive credit for this assignment.

## Goals:

1. Use data gathered from the US Census TIGER/Line dataset described at <http://www.census.gov/geo/maps-data/data/pdfs/tiger/tgrshp2010/TGRSHP10SF1CH5.pdf>
2. Utilize PostGIS functions documented at [http://postgis.net/docs/manual-2.0/reference.html#Spatial\\_Relationships\\_Measurements](http://postgis.net/docs/manual-2.0/reference.html#Spatial_Relationships_Measurements)

**Understanding the Dataset:** In this lab assignment you will connect to a database that I have created for the entire class to use. You will have read-only access to this database. Instead of logging into your own database using only the `psql` command you will use the following command to access this database:

```
psql cs3380gis
```

This database has a single schema within it named `public`. Type the `\d` command to see the list of database tables (and other objects) contained within.

Write the following query and execute it:

```
SELECT name10 FROM tl_2010_us_state10;
```

It should return 52 records corresponding to the 50 states, the District of Columbia and Puerto Rico. **If you have any permissions problems running this query, contact me ASAP.**

Notice the two tables named `tl_2010_us_state10` and `tl_2010_us_uac10`. These two tables that represent states and urban areas within the United States. Information on the data contained within these tables can be found within the PDF listed above in Tables 5.17.1 and 5.23.1 respectively. In addition to the fields listed in the PDF, each table created in the database has a geometry column (named `coords`) associated with it.

In summary, the following information is all that is required to complete the assignment. The state table (`tl_2010_us_state10`) has a field called `name10` that contains the state name; it also contains a field named `stusps10` that contains the United States Postal Service 2 character state abbreviation for each state. The urban area table (`tl_2010_us_uac10`) contains a field called `name10` that contains the name of the urban area. Both tables contain fields that represent the area in **square meters** over land (`aland10`) and water (`awater10`) for the state/urban area. Finally, both tables contain a field named `coords` that contains the WKB geometry for the geographic area represented by each record in latitude-longitude (SRID = 4326). These fields are to be used in this assignment with PostGIS function calls.

**Queries:** Create a new file named `lab9.sql`. For each question that follows, write a SQL statement in that file that uses PostGIS to satisfy the return the desired result. Each query requires the use of one PostGIS function (with the obvious exception of first question which requires the use of `ST_MakeBox2D` or `ST_GeomFromText` in addition to a function that checks for the required spatial relationship.) None of these queries require particularly complex SQL; if you're writing an insanely complex query, you've over-analyzed the question.

In each description I highlight in bold the word that should guide you to the relevant PostGIS function for the query. Additionally, in each question, I'm providing you with the expected number of records returned. Be sure that your queries return the appropriate number of results. Finally, in many cases, I'm explicitly telling you some or all of the column names that should be returned; these are noted in parenthesis.

1. Return the names of the states (`name10`) that **intersect** a rectangular polygon formed with a lower left corner at  $110^{\circ}W, 35^{\circ}N$  and an upper right corner at  $109^{\circ}W, 36^{\circ}N$ . Order the results in descending order of state name. (Notes: When using PostGIS, negative values are used for longitude values west of the prime meridian and latitude values south of the equator. The “x” coordinate comes first in the space separated tuples; think about whether that’s latitude or longitude. Remember to include the SRID of 4326 to specify that your coordinates are lat-long. Finally, refer to the notes from lecture for an example of how to use `ST_MakeBox2D` or `ST_GeomFromText`.) (*2 records*)
2. Which states **touch** North Carolina? Return USPS code (`stusps10`) and the name of each state (`name10`) alphabetized by the name in ascending order. (*4 records*)
3. Return the names (`name10`) of all urban areas (in alphabetical order) that are entirely **contained** within Colorado. Return the results in alphabetical order. (*64 records*)
4. Return all names (`name10`) and the combined (land and water) area in **square kilometers** of all urban areas that **overlap** some portion of Pennsylvania, but are not entirely contained within Pennsylvania. The query results should be ordered in decreasing area from greatest to least. (*17 records*)
5. Which pairs of urban areas **intersect** each other? Exclude self-intersections. Return the names of the urban areas (`name10`). (Note: If A and B intersect one another, only return the tuple {A,B} **or** {B,A}, but **not** both. Think about how to use the gid to enforce this.) (Note #2: The straightforward query that I wrote for this took ~25 seconds to execute. Be patient!) (*84 records*)
6. Find all urban areas that (1) have a combined land & water area of greater than 1500 **square kilometers** and (2) **intersect** multiple states. Your query should return the urban area name (`name10`) and a count of the number of states intersected. The results should be first ordered by the number of states intersected (in descending order) and secondarily by alphabetical order of the urban area names from (A to Z). (Note: Pay very close attention to the units used for the areas in this question.) (*10 records*)