CSCI 5980
Seminar on Location-aware Technologies

ASSIGNMENT 3
Web Cartography

Introduction
The Internet has revolutionized the practice and consumption of cartography. The goal of this assignment is to give you a sense of the state-of-the-art of Web cartography. It's going to be a relatively short assignment, and hopefully a fun one!

Points will be split evenly across all four tasks.

I'm assuming a basic knowledge of CSS. If you have zero CSS experience, e-mail me, and we'll figure something out!

Getting Started
After much debate, I settled on TileMill/MapBox as the web cartography stack we'll use for this assignment. MapBox is widely recognized as on the forefront of web cartography, and TileMill is an integral part of its stack. The first step in this assignment is thus downloading and installing TileMill (https://www.mapbox.com/tilemill/). TileMill is much easier to install than QGIS (esp. if you have a Mac), and it works across all three major desktop platforms.

You'll be using MapBox's centrally hosted servers to publish your map, but MBTiles can also be served using a few open-source packages. I wanted to make sure that you all learn something you can deploy with minimal cost if necessary for a research project or task at work!

Resources
This assignment will not walk you through individual steps like Assignment 2. I want you to explore and fiddle a bit on your own. However, should exploration turn into frustration, the following resources should help you keep calm and carry on:

https://www.mapbox.com/tilemill/docs/manual/
https://www.mapbox.com/tilemill/docs/guides/add-shapefile/ (← particularly awesome)

Task #1: Make a super ugly map

TileMill comes with a few sample projects. Open the "Road Trip" project. You'll see that TileMill is based on something called "CartoCSS", which is a basic extension of regular CSS.

Your first assignment will be to modify the "Road Trip" project to make the ugliest possible map you can. I mean, go *really* ugly.

Todo #1: Export the map as a png and include it in your assignment document (use a zoom level that fits the entire USA).

Task #2: Make a basic reference map of the Twin Cities
Now that you've offended the sensibilities of all sane cartographers, let's mend fences. You're now going to make a *nice* *reference* map of the Twin Cities. Using the guide at https://www.mapbox.com/tilemill/docs/guides/add-shapefile/ and the data at http://www.datafinder.org/catalog/index.asp, make a nice, basic reference map of the Twin Cities. Include at least 2 layers, but no need to go crazy with this. Make sure you modify at least some of the default styling.

Do this is in a new project, of course, and remember to hit "Save and Style" when adding layers rather than "Save" to avoid a common source of confusion.

Todo #2: Make a MapBox account and publish this map to that account. Include a link to the map in your homework assignment.

Task #3: Make a basic thematic map of the Twin Cities

For this step, you'll need QGIS and TileMill. The reason this is the case is that TileMill does not have any data classification algorithms built-in. So, in order to figure out where to make the class breaks (esp. for non-trivial algorithms like natural breaks), QGIS is quite helpful.

As a convenience, I've made a shapefile that is the result of joining the CountiesAndCTUs shapefile and ACS data file (with some flourishes) from Assignment2. You can download this file here: http://brenthecht.com/teaching/csci5980lat2014/spatial_data/CountiesAndCTUsACS.zip.

In a new TileMile project, add this shapefile. Next, load this file in QGIS. Go to the shapefile layer's properties and choose "Graduated".
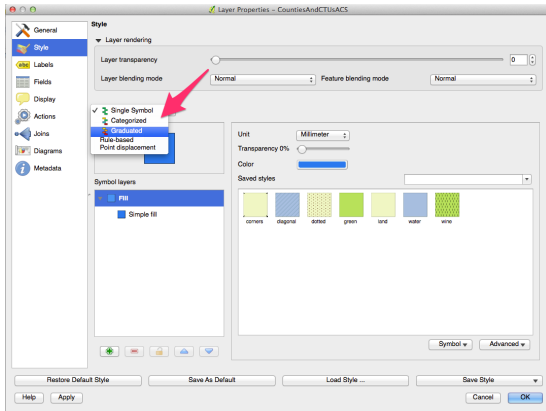
Next, choose which socioeconomic attribute you want to map. You can use the HTML file included with the shapefile to find out what each attribute name means (Note: All attributes have an extra "_" in the shapefile and may be missing a final character. This is a product of QGIS not being quite fully baked ☺).
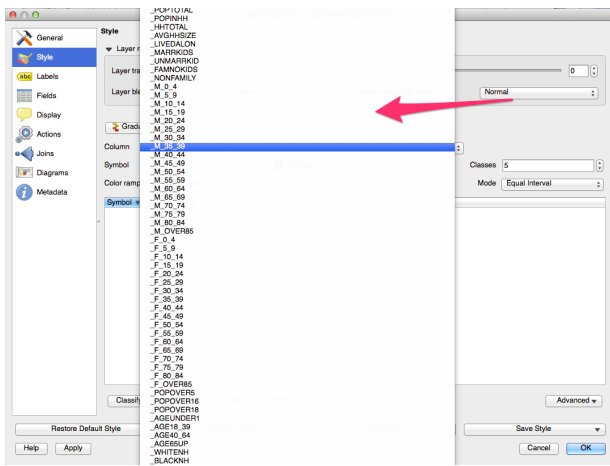
Next, choose the appropriate classification mode/algorithm for your attribute.
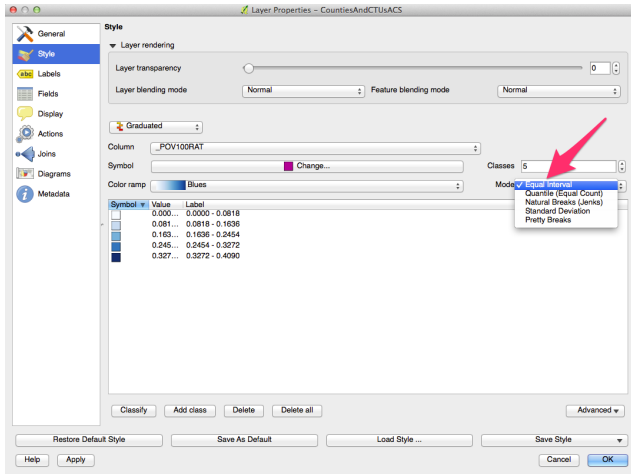
Todo #3: Justify your choice of classification mode/algorithm.

Using these class breaks and colorbrewer.org (be sure to use the correct option for "nature of your data"; hint: it's usually sequential) to make your thematic map. For example, I chose the "_POV100RAT" variable and this is my CartoCSS:

```
#counties {
  line-color:#000;
  line-width:0.5;
  polygon-opacity:1;

  [_POV100RAT >= 0.000] {polygon-fill:#fef0d9;}
  [_POV100RAT >= 0.052] {polygon-fill:#fdcc8a;}
  [_POV100RAT >= 0.105] {polygon-fill:#fc8d59;}
  [_POV100RAT >= 0.183] {polygon-fill:#e34a33;}
  [_POV100RAT >= 0.298] {polygon-fill:#e34a33;}
}
```

I used a natural breaks classification (from QGIS) and a reddish sequential color scheme from colorbrewer.org.

Now, let's add some interactivity and a legend. When you mouse over each city, give the user a message indicating the value of the attribute that is being visualized in natural language. To accomplish this, use the lovely guide at https://www.mapbox.com/tilemill/docs/crashcourse/tooltips/, focusing on the "Tooltips" section. My text in the "Teaser" tab is:

```
The poverty rate in {{CTU_NAME}} is {{_POV100RAT}}
```

Finally, let's add a legend appropriate for a choropleth map. For this task, use the guide at https://www.mapbox.com/tilemill/docs/guides/advanced-legends/. We'll be making a vertical qualitative legend, so scroll down a bit. The HTML here looks scary, but you only have to pay attention to the top part. Mine looks like this:

```
<div class='my-legend'>
<div class='legend-title'>Percent of the population below the poverty
line</div>
<div class='legend-scale'>
  <ul class='legend-labels'>
    <li><span style='background:#fef0d9;'></span>0 - 5.2%</li>
    <li><span style='background:#fdcc8a;'></span>5.2% - 10.5%</li>
    <li><span style='background:#fc8d59;'></span>10.5% - 18.3%</li>
    <li><span style='background:#e34a33;'></span>18.3% - 29.8%</li>
    <li><span style='background:#e34a33;'></span>>29.8%</li>
  </ul>
</div>
<div class='legend-source'>Source: <a href
http://www.datafinder.org/">MetroGIS</a></div>
</div>
```

Task #4: Publish this map to your MapBox account and include a link in your
homework document.