

GARP 0544 Cookbook: 4 March 2013

GIS Outputs GIS Tutorial Ch. 3

Overview

1. GIS Map vs. GIS Poster
2. Map Making Suggestions
3. Review: Custom Attribute Scales / Custom Classification
4. 13 Cities in W-MA Mini Project
5. Your Turn: Chapter 3
6. Homework Assignment #4

Chapter 3 takes you through a series of steps and tasks, aimed at showing you how to make better and more sophisticated maps with ArcGIS by using templates, adding reports, and adding graphs. Ultimately, a professional GIS map typically includes more than just a map. You can also show information using tables and graphs to supplement the information shown by the map.

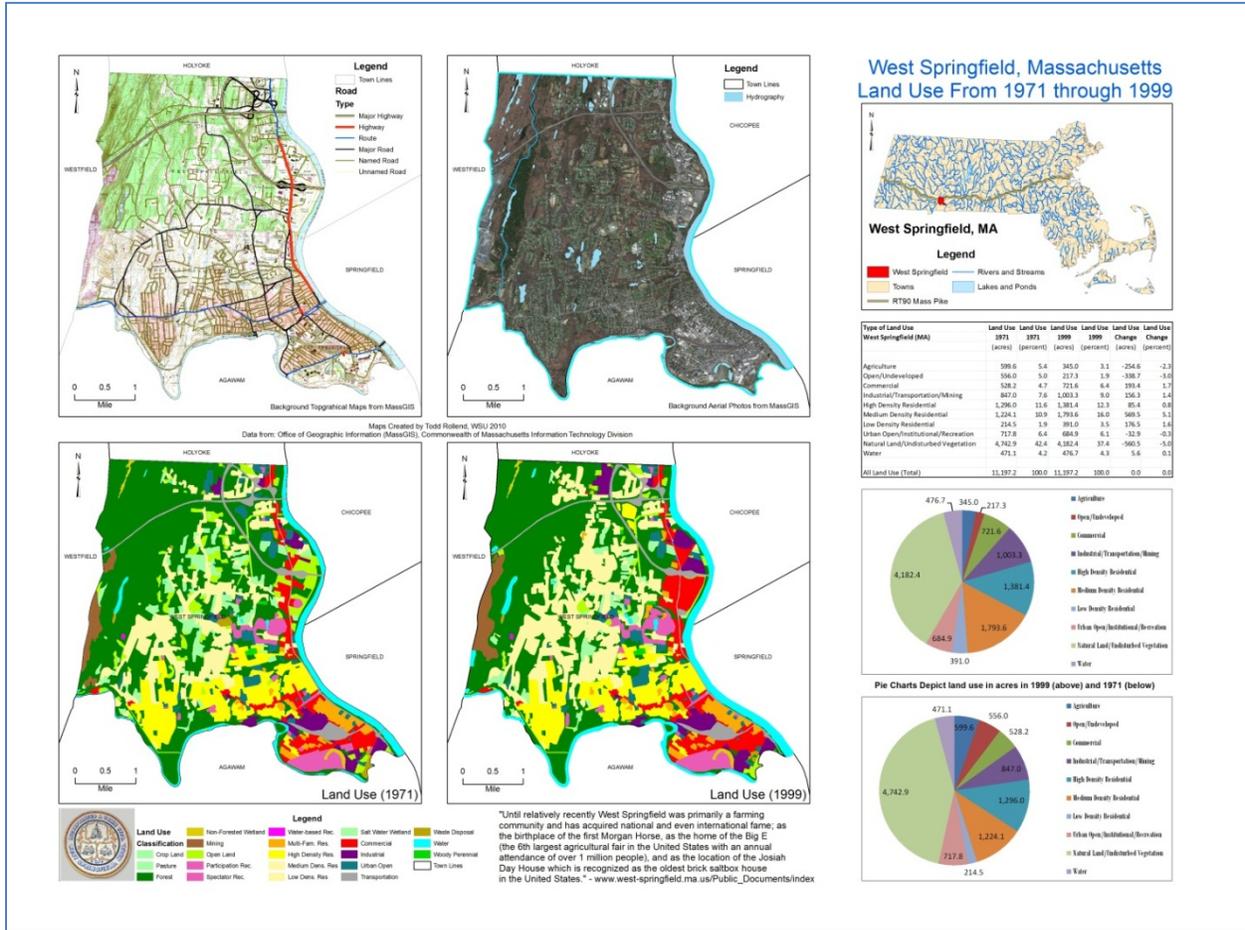
This is important!

Often, the results of a GIS analysis are shown as tables or graphs – in addition to a map. Or, sometimes the map is merely a location map and the real analysis is performed in MS Excel.

Chapter 3 also includes an introduction to data driven pages and map animations. In addition, we will review choropleth maps and custom attribute scales/custom classifications this week.

1) GIS Map vs. GIS Poster

Sure, the result of a GIS analysis can simply be a map. More often, however, the results of a GIS analysis are presented as a GIS Poster that combines multiple maps, charts, tables, and text.



This GIS Poster shows the results of a land use change analysis between 1971 and 1999 for West Springfield (MA). Overall, this is not really a map, but rather a canvas or poster compiling various ways you can present your data and analysis.

- 5 data frames with 5 maps.
- 1 table summarizing the results, created in MS Excel.
- 2 pie charts illustrating one important aspect of the results, created in MS Excel.
- Text explaining the analysis and the results.
- The GIS Poster is accompanied by a written report documenting the analysis, presenting the results, and discussing the implications.

The entire poster with the 5 data frames and associated legends was created in ArcGIS. The table and pie charts were created in MS Excel and copied/pasted into ArcGIS.

➔ *That's a GIS!*

In Chapter 3 you learn how to include reports and graphs created in ArcGIS to your map and how to create a map with more than map = more than one data frame. Later on we will use MS Excel to create tables and charts and how to add those to a map creates in ArcGIS.

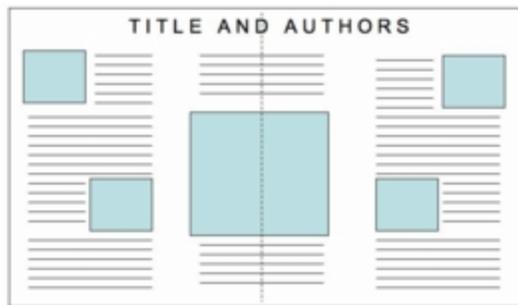
Your GIS poster should be able to ‘stand-alone’ and be understandable without additional explanations or an accompanying written report. Think of it as being displayed on the wall outside of Bates 22 – a normal person walking by should be able to fully understand your poster.

Poster Design Tips

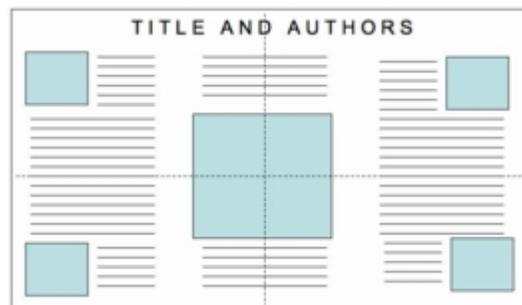
- <http://www.ncsu.edu/project/posters/NewSite/index.html>
- <http://www.bio.miami.edu/ktosney/file/Good8X10.pdf>
- http://www.kumc.edu/SAH/OTEd/jradel/Poster_Presentations/PstrStart.html

There are language-specific ways in which most people read. In English, it is top-to-bottom and left-to-right. Wheildon (1995) called this "reader gravity." You should not use organizational constructs that defy reader gravity - it will confuse viewers, which is not what you want to happen.

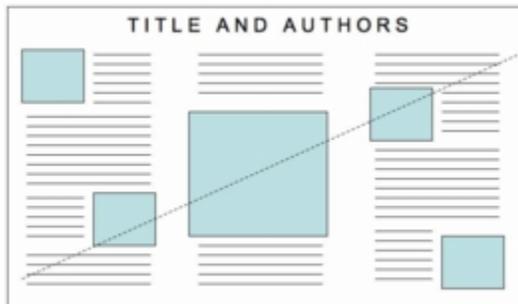
Your poster should have a good visual balance of figures and text, separated by white space. Balance occurs when images and text are reflected (at least approximately) across a central horizontal, vertical, or diagonal axis. This axis is known as the axis of symmetry.



Horizontal Symmetry



Vertical Symmetry



Diagonal Symmetry



Asymmetry: text-heavy on the left side, image-heavy on the right side

After: <http://www.ncsu.edu/project/posters/NewSite/CreatePosterLayout.html>

2) Map Making Suggestions

Overarching Themes

- Data Organization: Use dedicated folders! The key is to start organized – it is very difficult to organize a mess afterwards.
- Always save your map with relative pathnames.
- Project Documentation: Document your analysis steps – informally for your own benefit and formally as part of your reports.

Think about your finished map before you start mapping!

It is always easier to set-up your map sheet, margins, and data frames *before* starting to add data layers and adjusting the symbology.

- Adjust your map size immediately. Most of your maps will be 8.5 by 11 inches, but some of the maps for your projects will be 18 by 24 inches or even larger.
- Leave at least 0.5 inch (large maps: 1 inch) margins around all map elements.
- Create your data frames immediately before you start adding data.
- Use the guidelines to define your margins and to align your map elements.

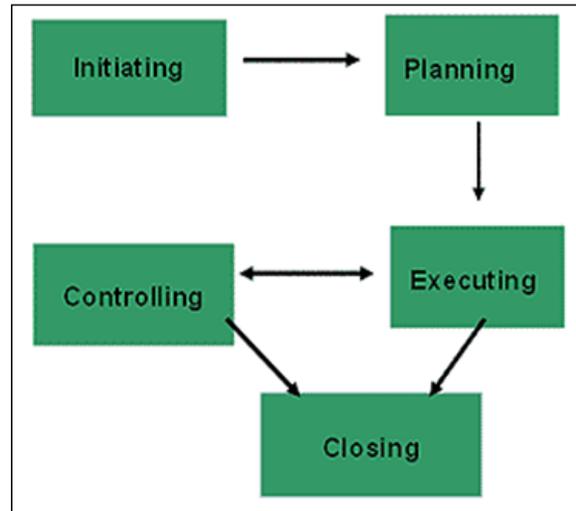
Think about classifications and colors!

- Don't just accept the ArcGIS defaults! You are making a deliberate choice by accepting the defaults – make sure your classification is meaningful and consistent between the data frames.
- Choose your colors and/or symbol sizes carefully.

Details matter!

Avoid typos, sloppy alignments, and other mistakes. Print your map and report and proof-read!

- Use titles for each data frame, and a title for the map as a whole.
- Include a scale bar, legend, north arrow for each data frame.
- Use consistent font sizes.
- Align your data frames and map elements using guidelines.
- Finishing touch: add a border (= neat line) around all map elements.



Making Better Maps!

See <http://www.westfield.ma.edu/cbraun/resources/gis-resources/>

3) Review: Custom Attribute Scales / Custom Classification

In this example you will create a map with two data frames: one showing the cities in Massachusetts as a choropleth map, the other showing the cities in Connecticut as a choropleth map. Six steps:

1. Prep work and map set-up – get organized!
2. Add data
3. Create the choropleth maps
4. Adjust the classification system
5. Add the finishing touches
6. Print or export map

3.1) Prep Work and Map Set-up

1. Start a new blank map in ArcMap and open the ArcCatalog window on the right side.
2. Create two folder connections:

To C:\ESRI\Press\GIST1\Data	Location of your data
To \garp0544spring2013\week7	Location to save your map

It is helpful to perform these two steps at the start – create your folders and folder connections – that makes things easier and more convenient later on.

3. In ArcMap switch to the Layout View (View – Layout View). The default is a 8.5 by 11 inch map in portrait orientation. This is a good choice for our map. However, change the default as needed for whatever map you are creating.
4. Add four guidelines 0.5 inch from each edge of the paper by clicking on the ruler and moving the guidelines as needed. Add two more horizontal guide lines at 5.5 inch and 6 inch.

This is important!

Use the guidelines to size and align your data frames and map elements. Always add the four guidelines at least 0.5 inch from the paper margin. You should never have anything closer than 0.5 inch from the margin...otherwise the printer will most likely cut it off.

5. Re-size the Data Frame so it fits in the upper ‘box’ created by the guidelines. Your data frame will be 7.5 inches wide and 4.5 inches tall.
6. Click on the Data Frame to select it, select Copy, and select Paste to add a second identical data frame to your map. Move the new data frame into position in the lower ‘box’ created by the guidelines.
7. Double-click on the upper Data Frame.
The selected Data Frame is highlighted as active using diagonal hash marks in the map window and the selected Data Frame is also highlighted in bold in the Table of Content.
8. Go to Data Frame Properties by right-clicking on the Data Frame in the Table of Contents, select Properties, select the General Tab, and change its name to: Cities in MA.

9. Repeat Step 8 for the lower Data Frame and name it: Cities in CT.
10. File – Map Document Properties...and check the box to store relative pathnames.
11. Save your map as mydemo1.mxd to your USB flash drive into the \week7 folder.

This was the prep work for our map.

We created the folder connections and the two data frames we need for our map. It is always a good idea to spend some time setting up the map and data frames *before* you start adding data.

➔ Always rename the data frames in the Table of Content – give them a name that describes what they show. Now we are ready to add data to each Data Frame.

This is important!

When you *single-click* on a data frame...

- The data frame is selected and gets the 8 little squares around its margin.
- Now you can move and resize the data frame.
- Move the mouse over the data frame, right-click, and you can select the Properties of the data frame.

When you *double-click* on a data frame...

- The data frame is now surrounded by short, diagonal hash marks.
- Now the data frame is active and it is shown in bold in the Table of Content.
- Now you can change the symbology, create definition queries, change the classification, etc.

Thus: Single-clicking allows you to change the way a data frame looks!

Whereas: Double-clicking allows you to work with the GIS data shown in the data frame!

There can be only one active data frame – shown in bold in the Table of Contents. Always activate whatever data frame you want to work on by double-clicking first!

3.2) Adding Data

1. Double-click on the Data Frame Cities in MA (to make it active) and add two feature classes from the UnitedStates.gdb geodatabase located C:\ESRI\Press\GIST1\Data: USStates and USCities.
2. Use the Definition Query function to display only the cities in MA and zoom in as much as possible into Massachusetts and Connecticut.
3. Repeat Steps 1 and 2 for the Data Frame Cities in CT, except use the Definition Query function to display only the cities in CT.

3.3) Creating the Choropleth Maps

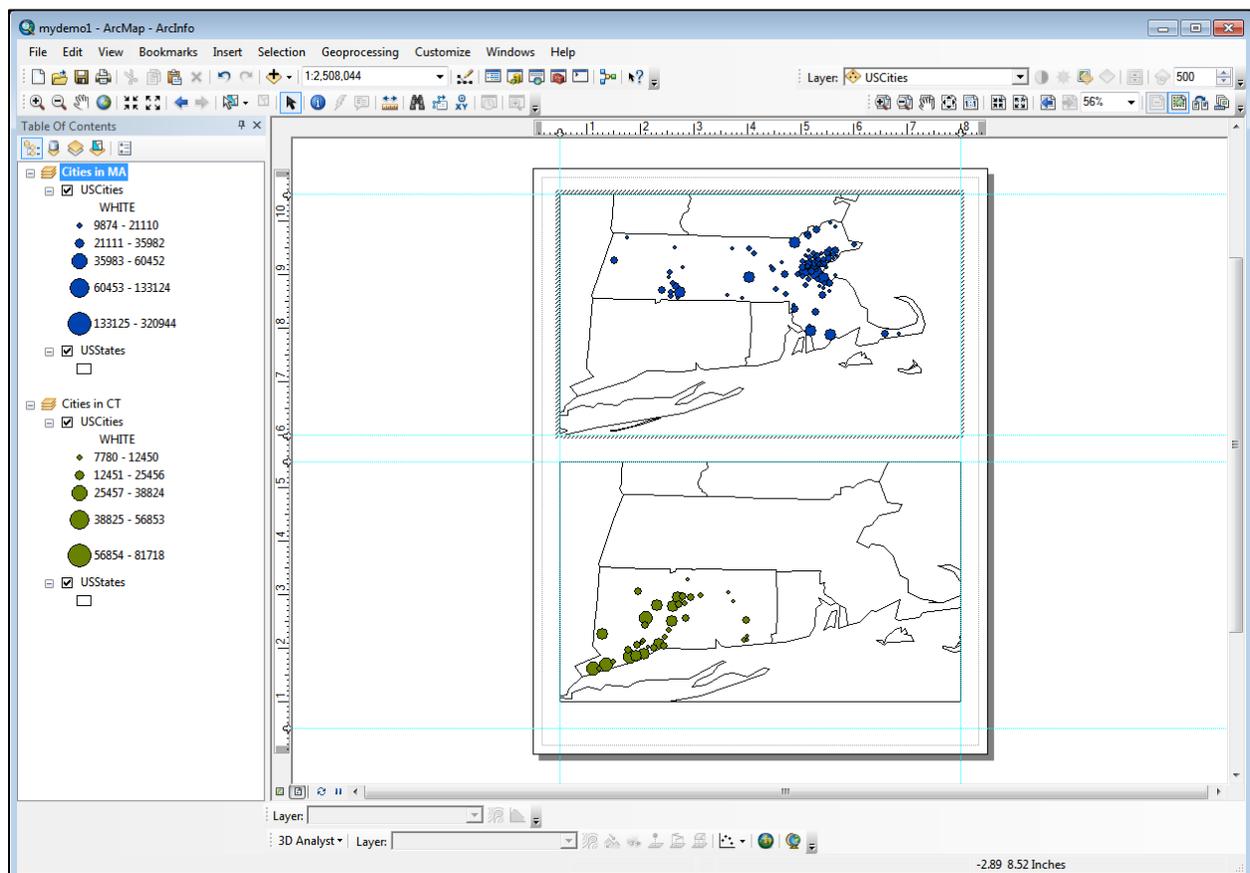
1. Use Symbology – Quantities – Graduated symbols, select WHITE as Value, and click OK. Repeat for both Data Frames.
2. Save your map as mydemo2.mxd to your USB flash drive into the \week7 folder.

You now have a choropleth map in each data frame where the size of the circles is a function of the number of white people in each city. By default, ArcGIS classified the data into 5 classes, using the Natural Breaks classification system.

There are three issues with your map!

- Showing the absolute number of white people in each city is not very meaningful, since that depends on the total number of people living in each city.
- Your classification scales are different between the two data frames: A circle of a given size does not mean the same thing in both data frames.
- Your zoom level or scale is different between the two data frames.

These three issues must be fixed to create a meaningful map in which you can compare the cities in Massachusetts and in Connecticut in terms of their population.

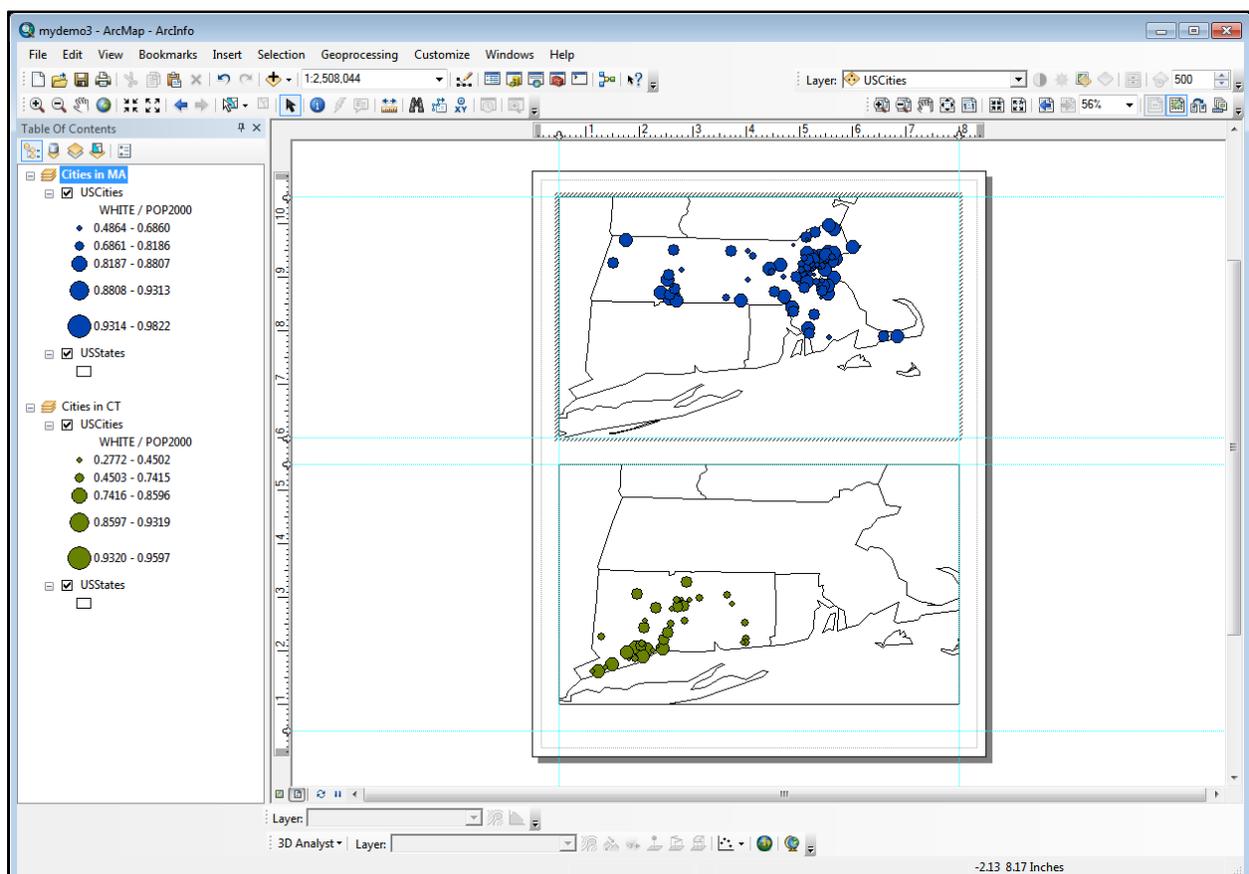


3.4) Adjusting the Classification System

It is better in this case to show the the number of white people as a function of total population – that is show as a percentage = normalize whites by total population.

1. Use Symbology – Quantities – Graduated symbols, select WHITE as Value, and POP2000 as Normalization. Repeat for both Data Frames.
2. Save your map as mydemo3.mxd to your USB flash drive into the \week7 folder.

Now your map is more meaningful and shows the size of the circles is a function of the percentage of white people in each city. By default, ArcGIS classifies the data into 5 classes, using the Natural Breaks classification system.

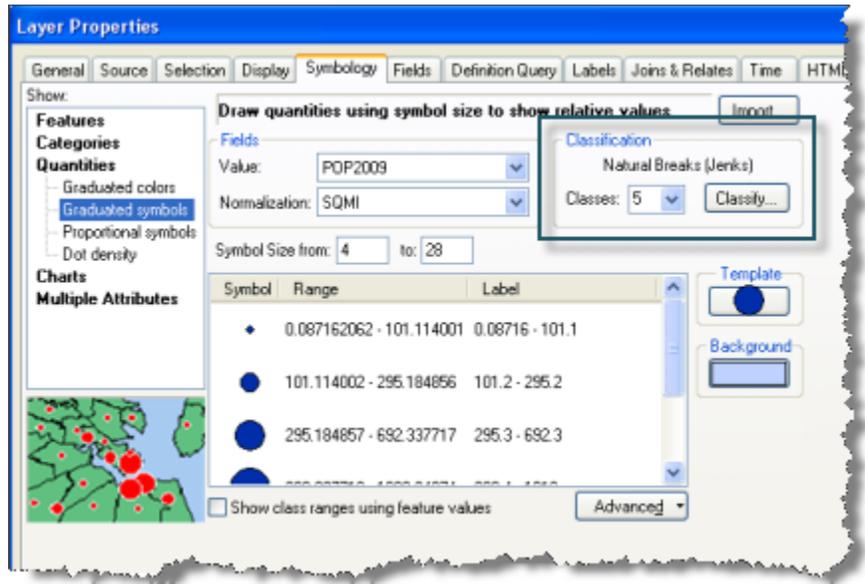


Please note!

- You should take this default classification system only as a first start – and modify it to suit your specific need or to make the map easier to understand.
- In this case, you **MUST** have the same classification system in both data frames, otherwise you create an incorrect impression when comparing the cities of Massachusetts and Connecticut.

For example, here we (may) want 6 classes

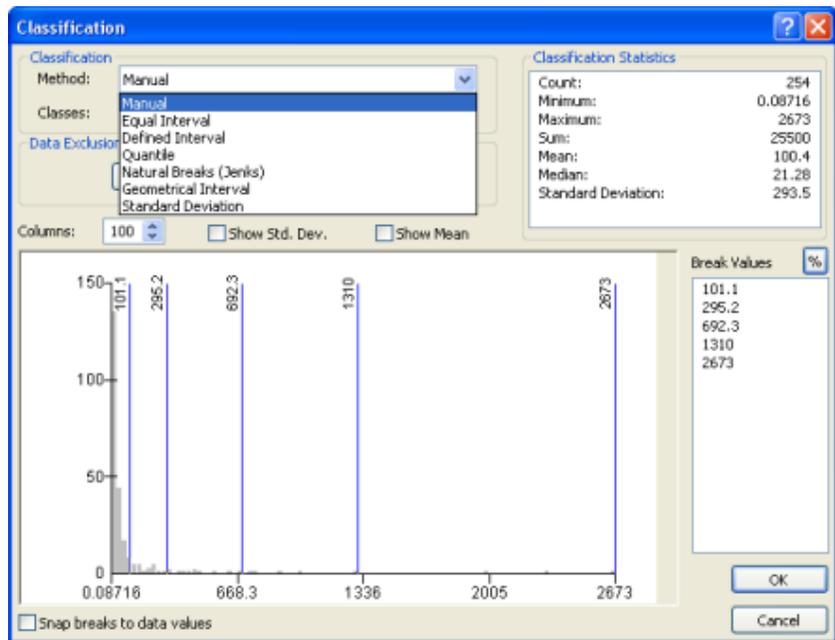
- Less than 50%
- 50 to 60%
- 60 to 70%
- 70 to 80%
- 80 to 90%
- 90% and greater



Symbol Size Defines the smallest and largest size and assigns intermediate sizes depending on the number of classes.

Label Defines how each class/range is labeled in the Table of Contents and the legend.

Classify Defines the actual classes/ranges.



Important!

Changing the symbol size or label does NOT change the actual underlying classification!
 The only way to change the actual underlying classification is to 1) click the 'Classify...' button, 2) change the Classification Method to 'Manual' and 3) change the Break Values.

3. Change the number of classes to 6, change the Classification to Manual and enter the new Break Values suggested above. Repeat for both Data Frames.
4. Now you can modify your labels, your symbol size range, your specific symbol sizes, and symbol color to give you a more understandable map. Repeat for both Data Frames.
5. Save your map as mydemo4.mxd to your USB flash drive into the \week7 folder.

If you want to show another state (e.g. Vermont), you should use the exact same classification method, break values, symbol sizes, symbol colors, etc. to avoid misleading the map user.

3.5) Add the Finishing Touches

Now we need to add the finishing touches to make our map truly professional

1. Match the zoom level of each data frame so that each data frame shows exactly the same area. Select MA and CT in the upper data frame. Choose Selection – Zoom to Selected Features. Clear the selected features.
2. Repeat Step 1 for the lower data frame.
3. Add a title, north arrow, legend, and scale bar to each data frame.
4. Add your name, affiliation, date, and data credits below.
5. Save your map as mydemo5.mxd to your USB flash drive into the \week7 folder.

Now you have a meaningful choropleth map! You have two data frames with the same custom classification system and the same map scale. You are showing your data as percentages, not as absolute values.

Final Considerations

- We should have made the data frames smaller to leave room for a map title and neat lines surrounding all map elements.

➔ *Always leave yourself enough room! Do not use the entire page for your data frames!*

- Technically we only need 1 north arrow and 1 scale bar on this map since both data frames are identical in that respect.
- We could have only used 1 legend if we had used the same colors in both data frames.
- We saved our map after every significant mapping step using a sequential number. That way we can always revert back to an earlier version of the map as needed.

3.6) Print and Export the Map!

Export as PDF and JPG into \week7 folder.

4) 13 Cities in Western MA Mini Project

See separate handout.

5) Your Turn: Chapter 3

Chapter 3 takes you through a series of steps and tasks, aimed at showing you how to make better and more sophisticated maps with ArcGIS, for example:

1. Using Map Templates and Layouts
2. Adding Reports (i.e. tables) to your map.
3. Adding Graphs (crucial!) to your map.
4. Exporting maps as images

Make sure you save all your maps, layers, reports, templates, etc. throughout this chapter to your USB flash drive into the `\garp0544spring2013\week7` folder.

Tutorial 3-2: Map Layouts

A map layout is a simple file that controls how a map is displayed and printed. A layout is not a map – just a ‘container’ to present a map. You can use the same map layout for many different maps. ArcGIS contains a wide range of map layouts to make good-looking maps – fast! Of course, you can also create your own map layout.

Tutorial 3-3: Reusing Layouts

The idea here is simple: once you create a suitable layout you can reuse it again and again to create maps. That saves time, but more importantly, it ensures that all maps in a collection are 100 percent consistent.

Tutorial 3-4: Layouts for two maps or more!

Now it gets interesting: you can have as many maps as you want displayed on a page – each map is displayed in its own data frame.

- A GIS map contains 1 or more data frames.
- Each data frame contains 1 map.

Tutorial 3-5: Adding Reports

Reports allow you to include data/information on your map in a table format to emphasize a particular aspect of your analysis in a table. Some type of information is best shown as a table, rather than a map or a graph. The Report tool is great, but a bit tedious...so please be careful and follow the instructions!

- Creating a report is easy – modifying a report as described on Page 105 and 106 can get tedious – focus on the big picture here!
- Page 107 is important: you learn how to export your report as a MS Excel file and then insert the MS Excel table into your ArcGIS map simply using copy and paste.
- Print your map if possible!

Tutorial 3-6: Adding Graphs

You can make simple graphs directly in ArcMap, but ArcMap does not allow you many design options. Therefore, it is often better to export the data into Microsoft Excel, perform whatever calculations are needed, create a graph in Microsoft Excel, and paste the Microsoft Excel graph into your ArcMap layout.

- Print your map if possible!

Tutorial 3-7: Data Driven Pages

This is a new feature in ArcGIS 10 – data driven pages. This is best explained with an example: Suppose you have an overall map of Massachusetts showing the town lines of the 351 cities and towns, locations of schools, and public parks. Now you want to create a map series of 351 maps = 1 for each town. The output here can be images or a PDF file with 351 pages.

Tutorial 3-8: Map Animations

This is another new feature in ArcGIS 10 – map animations!

In other words: maps can now show geographic data with a time component.

The tutorial uses daily crime alerts in a neighborhood of Pittsburgh, but you can time-animate any geospatial data with a time component, for example:

- Election results every 2, 4, or 6 years.
- Daily measurements of rainfall.
- Weekly traffic counts.

6) Homework Assignment #4

This assignment reinforces and expands the skills you have learned in Chapters 2 and 3 of the GIS Tutorial, including definition queries, choropleth maps (using point symbols), custom classification scales, and map layout using 3 data frames.

This assignment is similar to Assignment 2-1 of the GIS Tutorial, but modified and expanded.

Scenario

You work for the school committee of the City of Pittsburgh and you want to make a map showing the schools in Pittsburg with open enrollment and, at the same time, showing who runs the school. Furthermore, you want to show how many students are currently enrolled in each school.

Data

- C:\ESRI\Press\GIST1\Data\Pittsburgh\City.gdb\Neighborhoods
- C:\ESRI\Press\GIST1\Data\Pittsburgh\City.gdb\Schools

Part 1: GIS Mapping

Create a map (in 8.5 by 11 inches, portrait orientation) of Pittsburgh with three data frames (each with the same size and zoom level) showing the location and enrollment of local schools within each neighborhood.

- Your data frames show only the schools with open enrollment (using the STATUS field in the attribute table).
- Your data frames show the schools in different colors, depending on who runs the school (using the DISTRICT field in the attribute table).

Top data frame	Public	City of Pittsburgh	Yellow circles
Middle data frame	Church	Pittsburgh Diocese	Red circles
Bottom data frame	Private	Private School	Green circles

- The data frames show the enrollment of the schools = the size of the circles is a function of enrollment (using the ENROLL field in the attribute table).
- Use the same classification ranges/break points/circle sizes in all three data frames to make them consistent and comparable. I suggest the following five ranges for enrollment: 0-100, 101-200, 201-400, 401-800, 800 and greater.
- Your map has to include the required map elements, including titles for each data frame and a separate legend for each data frame.

Hints and Tips

- Use guidelines to size and align your three data frames. Suggested size for each data frame: width = 5.5 inches, height = 3 inches. This gives you enough 'empty' space on the map for your three legends.
- You will need a definition query for each data frame to sub-select the schools as needed. Please realize that you have 2 criteria for each data frame – STATUS and DISTRICT – which you need to combine with the appropriate logical operator.

- Save your map to your USB flash drive, into the \garp0544spring2013\week7 folder.
- Refer back to Section 2 and 3 for additional tips related to map making.

Part 2: GIS Analysis

1. How many schools are shown in the top, middle, and bottom data frame?
2. How many schools are located in the Beechview neighborhood?
3. How many schools are located in the Squirrel Hill South neighborhood?
4. What's the largest school in Pittsburgh? Who runs it?
5. How many schools are in Pittsburgh *overall* (regardless of enrollment)?
6. How many public, private, and church schools are in Pittsburgh overall (regardless of enrollment)?
7. What are the percentages of public, private, and church schools in Pittsburgh (regardless of enrollment)?

Part 3: Deliverables

Please submit professional, well-written report using proper English language and professional formatting and layout. Think in terms of using this report as a sample of your work for a job interview. Include:

- Include a starting paragraph describing and introducing your overall GIS analysis.
- A step-by-step documentation of your mapping and analysis procedure Think in terms of writing a cook book recipe that a similarly-trained GIS user can follow along to repeat your mapping and analysis. I need to be able to understand your methods to assess your work. Use a numbered list to organize your recipe.
- The three definition queries typed exactly as you created them in Query Builder.
- The answers to the seven questions, including an explanation of how you arrived at your answer.
- Your map, exported as a JPG image, and inserted in the last page of your report. Include a useful caption.
- Due Date: next class meeting

As always, include a cover page and page numbers in the page footer. Your report will have about 5 to 6 pages (cover page, ~3 to 4 pages for documentation and the questions, 1 page for the map).

Please note: the map, the analysis questions, the documentation, professionalism and attention to detail are all equally important in terms of your assignment grade. This is a difficult assignment, so please get started as soon as possible!

➔ *Contact me for help or clarification of this assignment or my expectations as needed.*