Geographic Systems and Analysis
Fall 2014 Syllabus

New York University
Robert F. Wagner Graduate School of Public Service

Instructor
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Office hours: Mondays by appointment

Schedule
Mondays, 4:55pm - 6:35pm
Sept 8 to Dec 8 & Wed Dec 10
Waverly Building, Room 668

Course Description
Understanding geographic relationships between people, land use, and resources is fundamental to planning. Urban planners routinely use spatial analysis to inform decision-making. This course will introduce students to Geographic Information Systems (GIS), a tool to analyze and visualize spatial data. The course will emphasize the core functions of GIS: map making, data management, and spatial analysis. Students will learn cartographic best practices, how to find and create spatial data, spatial analysis methodology, and how to approach problem solving from a geographic perspective. Throughout the course, students will build a portfolio of professional quality maps and data visualizations.

Objectives
Students will gain the following skills and abilities:

- An understanding of what GIS is and how GIS is used in planning and other fields
- Fluency in the ESRI ArcGIS interface (the most commonly used GIS software package)
- An understanding of where to find existing GIS data and how to create custom GIS data
- Ability to make professional quality maps
- Expertise in working with and visualizing geographic data
- Ability to solve a “spatial question” using GIS

Course Structure

Prerequisite
There is no prerequisite for this class, but students should be prepared to work extensively with data in various formats, including GIS shapefiles, excel spreadsheets, .zip files, text files, and more. Basic competency in Microsoft Excel is helpful.

Class Format
Most classes will include a short lecture introducing a spatial analysis/GIS topic followed by a hands-on lab exercise (see class schedule). Materials for the lab exercises will be posted on the NYU Classes course site in advance of each class. Any remaining class time will be used to work on graded assignments.
Academic Integrity
Consulting with classmates, peers, online GIS resources, and NYU Data Services is encouraged. However, all graded assignments must be individually produced. For example, it is perfectly acceptable for a classmate to help troubleshoot a difficult task. It is not acceptable to turn in an assignment using output generated by a classmate (such as a shapefile). Students are expected to abide by Wagner's academic code.

Graded Assignments
The assignments are an opportunity to build a portfolio of professional quality GIS work. Revisions will be accepted for the first two assignments (Map Portfolio and Spatial Analysis Memo). Late work will NOT be accepted. More detail about the assignments and grading will be discussed in class.

Note: Though lab and text exercises are not graded, the skills covered are necessary to complete the graded assignments. Students are responsible for mastering the assigned material.

1. Map Portfolio – 25% of grade
Due October 6 (revisions due October 27)
Create a series of maps that tell a story about a particular neighborhood or place. The graded deliverable is a package of 5-7 maps. The Map Portfolio must:
- Adhere to cartographic best practices, e.g. proper map projection
- Include a legend, scale, north arrow, insets, and/or other map elements as appropriate
- At least 3 of the maps must be thematic
- Maps must be titled and annotated so they can be read as a standalone product

For example, a Map Portfolio featuring Manhattan Community District 02 might include:
- Reference map of NYC Community Districts highlighting MN CD 02
- Choropleth map of NYC Community Districts symbolizing median household income
- Block-level reference map of MN CD 02 showing the locations of schools and fire stations
- Lot-level choropleth map of MN CD 02 symbolizing land use type
- Census tract-level map of MN CD02 showing population density

2. Spatial Analysis Memo – 25% of grade
Due November 3 (revisions due December 1)
Design and execute an analysis in ArcGIS that addresses a ‘spatial question’. The graded deliverable is a 2-3 page memo detailing the research question, data, analysis methodology, and results. The spatial analysis design should be multistep (include at least 2 geoprocessing tools). The memo will include:
- A statement of the research question
- Description of the methodology written for a non-technical audience
- Results (tables and maps, as appropriate)
- An appendix with a visualization (e.g. flow chart) of the ArcGIS geoprocesses used to perform the analysis
For example, a spatial analysis might address questions such as:

- How many New Jersey residents live in FEMA flood zones?
- How much allowable FAR is unused for each NYC Community District?
- What share of NYC residents live within a ½ mile of a subway stop?

3. Research Report - 50% of grade

Proposal due October 27; Report due December 8 (no revisions)

Develop a geographically focused research question or topic and submit a proposal by October 20. The graded deliverable is a report and presentation. The report must include a minimum of 5 maps and utilize at least 3 geoprocessing tools.

The research report can be oriented around a place or around an issue. For example,

- **Place-based research report example:** An in-depth look at Queens. The report will include maps showing demographic characteristics of neighborhoods within Queens, and borough level maps comparing Queens to NYC and NY State. Geoprocessing tools will estimate the percent of residents living near a park and the square footage of commercial buildings in flood zones.
- **Issue-based research report example:** An analysis of food access in the US. The report will feature maps of different food access indicators nationwide and at local levels. The report will explore how a spatial indicator such as ‘distance to a grocery store’ varies between rural and urban areas. Geoprocessing tools will estimate the number of people living in food deserts nationally and in select cities.

Course Materials

Software

Students wishing to install GIS software on their personal computers can receive a free educational license of ESRI ArcGIS 10.2 from NYU Data Services. Note: ESRI software only runs on Windows operating systems. Many NYU lab computers are equipped with ArcGIS.

Data Storage

Students should bring a USB flash drive to class (at least 8GB).

Reading

*Getting to Know ArcGIS for Desktop*, 3rd edition, by Michael Law and Amy Collins

Optional:

*Mapping It Out*, by Mark Monmonier (great cartography resource)
# Tentative Class Schedule

Subject to change. The schedule front loads essential topics and class time will be prioritized accordingly. Assigned reading and exercises are to be completed by the following class and refer to *Getting to Know ArcGIS*. Do all exercises in assigned chapter(s) unless otherwise noted.

<table>
<thead>
<tr>
<th>DATE</th>
<th>LECTURE TOPIC</th>
<th>LAB TOPIC</th>
<th>READING &amp; EXERCISES*</th>
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| **Sep 8** | **Introduction to GIS**  
• What is GIS?  
• Spatial data | **Explore ArcGIS interface**: layout and data views, table of content, ArcCatalog | *Chapters 1-4* | |
| **Sep 15** | **Map Making I**  
• Cartography 101  
• Map projection | **Reference maps**: map projection, saving and exporting in ArcMap | *Chapter 6*  
*Chapter 9*  
*Chapter 10* | |
| **Sep 22** | **Map Making II**  
• Symbolizing geographic data  
• Feature selection | **Thematic maps**: Table joins, definitions queries | *Chapter 7*  
*Chapter 8*  
*Chapter 11*  
*Chapter 15*  
*Chapter 16a,b* | |
| **Sep 29** | **Geoprocessing I**  
• What is geoprocessing  
• Spatial selection | **Overlay analysis**: select by location, spatial joins | *Chapter 16c*  
*Chapter 18a,b,c* | |
| **Oct 6** | **Geoprocessing II**  
• Measuring spatial relationships | **Proximity analysis**: buffers, point distance, select by location | *Chapter 17*  
*Chapter 19a,b,c* | **Map Portfolio** |
| **Oct 13** | | | | **NO CLASS - FALL BREAK** |
| **Oct 20** | **Data Generalization & Classification**  
• Generalization of data on small and large scale maps  
• Data classification & display | Work on assignments | | |
| **Oct 27** | **Spatial Problem Solving**  
• Designing and documenting a multistep spatial analysis  
• Model Builder | **Group geoprocessing lab** | *Chapter 18d* | **Map Portfolio (revisions)**  
**Research Report Proposal** |
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| Nov 3 | Spatial Data Measurement, Geocoding  
- Accuracy & Precision  
- Geocoding | Geocoding: from addresses, from coordinates | Chapter 14 | Spatial Analysis Memo |
| Nov 10 | Raster Data  
- Introduction to raster data | Raster Data: Interpolation | Chapters 20 | |
| Nov 17 | GIS & Urban Planning | Work on research report/memo | | |
| Nov 24 | Spatial Statistics  
- Geographic distribution  
- Cluster analysis | Feature editing: Manually editing vector data | Chapters 12 & 13 | |
| Dec 1 | Course Wrap Up  
- Course review  
- Advanced tools and applications | Work on research report | | Spatial Analysis Revisions due |
| Dec 8 | Research Report Presentations  
**Different location: Silver Bldg, Room 509 (100 Washington Sq East)** | | Research Report and Presentation | |
| Dec 10** | Research Report Presentations  
**Different location: Silver Bldg Room 620 (100 Washington Sq East)** | | | |

*Getting to Know ArcGIS.*

**Legislative Day - Classes meet according to a Monday schedule.*