UP 506: Introduction to Geographic Information Systems

Winter 2017

Lecture Time and Location: TR 2:30–3:30 PM, 2213 A&AB
Instructor: Eric Seymour
Email: eseymour@umich.edu
Instructor Office Hours: TBA

Lab Times and Location: Duderstadt Center, Advanced Training Lab 2 (3336 BD)

- R 4:30–7:00 PM
- F 8:30–11:00 AM
- F 1:00–3:30 PM

Graduate Student Instructor: Lauren Grove
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This syllabus is subject to change. The most recent version is posted at the Canvas web site.

Course Description

This course is designed to introduce students to the dynamic field of geographic information systems (GIS). The course has three interrelated objectives: (1) provide a foundation in concepts from cartography, spatial analysis, and computer science used in GIS applications, (2) develop specific skills using ESRI's ArcMap and other software applications through a set of hands-on exercises, and (3) allow students to apply these skills through a mapping project on a topic of their choosing. Although urban planning topics will be emphasized, the course is intended to serve as a general introduction to GIS. Students will learn the basic principles of GIS, how to retrieve and map spatial data, study examples of GIS analysis, and develop and implement simple analysis models of their own.

Note on Labs: Students should enroll in one of the three lab sessions, which will meet in Advanced Training Lab 2 in the Duderstadt Center. Lab attendance is mandatory. If for some reason a student cannot attend their own session for a given week, please ask the GSI to assign you to another session.

Prerequisites

This course assumes basic familiarity with personal computers and electronic file systems. Students should understand basic statistical concepts, covered in UP 503 or its equivalent.

Required Materials

1. Price, M. (2015). *Mastering ArcGIS* (7th edition). New York, NY: McGraw-Hill Education.
   Note: Please make sure you get the seventh edition. This book has a website that hosts all the data and teaching tutorials used in the labs. All supplemental readings will be available via Canvas.
2. USB flash drive with at least 2GB available memory

Major Assignments

No.	Item	Weight
1	Class participation and discussion (lecture and lab)	5%
2	Lab assignments	45%
3	Reading response posts	15%
4	Final project	35%

Lab Assignments

All lab assignments should be submitted at the beginning of your lab session in the due week. Each lab assignment will tell you in which week it is due. Lab assignments are self-paced. The textbook provides detailed step-by-step teaching tutorial on the functions you need to learn for each lab. The GSI may provide some supplemental instruction, depending on the topics. The rest of the time should be used to work on your assignment. Note that some assignments are weighted more than others.

Reading Responses

Students should post three total 300–500 word reading responses to Canvas before one of a limited number of reading-intensive lectures. Instructions will be posted on Canvas for each of the relevant lectures, but typically the responses should address the articles(s) assigned for that week and optionally respond to other students' posts. These weeks are indicated in the schedule with ⋆⋆⋆.

Final Project

Students can work individually or in groups of two or three on the final project. The project will be developed in three steps. First, you need to identify a topic that you would like to work on and submit a short paragraph describing the topic and one or two scholarly articles relevant to your proposed project. This is due Feb 23rd (5% of grade). Second, by Mar 23rd a detailed proposal is due describing the data sources and the analysis you plan to undertake (10% of grade). Third, the final product will be due the week of April 17th (20% of grade). Additional details on the final project will be provided separately.

Resources

Getting Help

GIS is professional software, meaning it is used by a community of expert users who are already familiar with its interface, specialized functions, and underlying concepts. This makes it different than software applications designed for use by general users, e.g., Microsoft Office. As a consequence, you may find GIS software to be buggy, confusing, and frustrating. When you encounter problems, there are several resources available to you:

1. Classmates
2. Class Canvas forum
3. Online help files, FAQs, listserves, and other resources
4. Course instructors and GSI
5. SAND Lab librarians

Corrupted files, error messages, missing menus, and other challenges you may encounter are not problems, but learning opportunities along the path of becoming a skilled professional GIS user!

Spatial and Numeric Data Services (SAND) Lab

The University Library's Spatial and Numeric Data Services (SAND) provides assistance with spatial data, numeric data, and statistics for the University of Michigan community. One of the two UM SAND labs is located at Taubman College in room 2207 of the Art & Architecture building. The lab supports students from Taubman College, in addition to those from other North Campus programs. SAND provides computers and software to help students and researchers work with spatial and numeric data and access to data only available from within our labs. These labs are equipped with ArcGIS, ArcView, ERDAS, SAS, SPSS, Stat-Transfer, Stata, Adobe Creative Suite (Photoshop, Illustrator, InDesign, Dreamweaver), and more. SAND also provides access to and assistance with data from the Inter-university Consortium for Political and Social Research (ICPSR), Roper Center for Public Opinion Research, Europa World Plus, Global Insight, Geolytics, the U.S. Census Bureau, the U.S. Geological Survey, and other sources.

UP 506 Sand Lab Use Guidelines: Students with questions arising from course assignments should inquire with classmates and course instructors before visiting the SAND Lab. After reviewing the provided Canvas links and conducting preliminary explorations, students are encouraged to consult with the SAND Lab librarians about data sources for the final project.

Course Policies

1. **Attendance at all lectures is required.** Please do the readings before each class. Please ask questions during lecture time, for your benefit and the benefit of your fellow classmates.
2. **Attendance at lab sessions is mandatory.** You should regard your time during lab sessions as precious. It is a rare time that you can interact with the GSI in front of a computer, and it provides a forum for working through problems with your colleagues. You will discover that GIS users in general tend to cultivate a community of mutual cooperation (through list-serves, conferences, user's groups, etc.). Please carry on the tradition and help one another. Note that your work during labs will be self-paced, with the GSI on hand for help. I expect you to come to lab prepared, so read the textbook prior to the lab session. You should sit through the entire lab time unless you finished the assignment.
3. **Participation in the online discussion group is strongly encouraged.** We will set up an online discussion group in Canvas course site. Anyone who has questions on the assignments can post there. Please help out your classmates if you know the answer to their questions. The GSI and I will check the thread periodically to make sure everyone is getting helped and to make corrections if necessary. Your participation in the discussion is also counted as part of the course participation grade.
4. **Lab exercises must be submitted at deadline.** Staying current with the pace of this course is important. There are many lab assignments. You will have a hard time catching up if you fall behind. You are expected to meet all deadlines. *Late submissions will be penalized 10% for each day late.*

University Policies

In addition to those specified here, policies which apply to students in this class include those of the Urban and Regional Planning Program, Taubman College, students' home academic units, and the University.

Academic Integrity

Taubman College Policy on Plagiarism:

> Plagiarism is knowingly presenting another person's ideas, findings, images or written work as one's own by copying or reproducing without acknowledgment of the source. It is intellectual theft that violates basic academic standards. In order to uphold an equal evaluation for all work submitted, cases of plagiarism will be reviewed by the individual faculty member and/or the Program Chair. Punitive measures will range from failure of an assignment to expulsion from the University.

Students will be provided guidance in class about academic integrity norms in GIS, including how to cite data sources and document analyses. Students with additional questions should contact the course instructor.

Accommodations for Students with Disabilities

It is Taubman College policy to "meet the educational needs of all persons, including those with physical or perceptual limitations, who are interested in the study of architecture, urban planning and/or urban design." If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Services for Students with Disabilities (SSD) office to help us determine appropriate academic accommodations. SSD (734-763-3000; http://ssd.umich.edu) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.

Accommodations for Religious Holidays and Observances

Students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall be provided with a reasonable alternative opportunity to complete such academic responsibilities. It is the obligation of students to provide faculty with reasonable notice of the dates of religious holidays on which they will be absent. Such notice must be given by the drop/add deadline of the given term.

Tentative Schedule

Note: This schedule includes readings for lectures that cover GIS theories and concepts. For lab readings, please refer to the next section.

1 Introduction to GIS and ArcGIS

R 1/5	Introduction: What is GIS?

T 1/10	Fundamental GIS Concepts Readings: • Price, Ch 1: GIS Data • Pamuk, A. (2006). *Mapping global cities: GIS methods in urban analysis*. Redlands, CA: ESRI Press (Ch 3: Urban planning applications of GIS in local government)
R 1/12	Fundamental GIS Concepts, cont.; Managing GIS Data Readings: • Price, Ch 2: GIS Data

2 GIS Data Structures

T 1/17	Data Structure: Vector and Raster Data Model Readings: • Price, Ch 1: Review pp. 9–18. • Bolstad, P. (2008). *GIS fundamentals: A first text on geographic information systems*. Geographic information systems fundamentals. White Bear Lake, MN: Eider Press (Ch 2: Data models)
R 1/19	Data Structures, cont.

3 Coordinate Systems and Map Projections

T 1/24	Coordinate Systems and Map Projections Readings: • Price, Ch 3: Coordinate systems • Monmonier, M. S. (1996). *How to lie with maps*. Chicago: University of Chicago Press (Ch 2: Elements of the map)
R 1/26	Coordinate Systems and Map Projections, cont. Readings: • Clarke, K. C. (2011). *Getting started with geographic information systems*. Prentice Hall series in geographic information science. Boston: Prentice Hall (Ch 2: GIS's roots in cartography) • Michigan Department of Natural Resources: Map Projections

4 Making Thematic Maps

T 1/31	Making Thematic Maps Readings: • Price, Ch 4: Mapping GIS data; Ch 5: Presenting GIS data

R 2/2	Making Thematic Maps, cont. Readings:⋆⋆⋆ • Monmonier, M. S. (1996). *How to lie with maps*. Chicago: University of Chicago Press (Ch 10: Data maps; Ch 11: Color) • Kent, R. B. & Klosterman, R. E. (2000). GIS and mapping: Pitfalls for planners. *Journal of the American Planning Association*, *66*(2), 189–198

5 Database Concepts and Applications

T 2/7	Database concepts Readings: • Price, Ch 6: Attribute data
R 2/9	Queries Readings: • Price, Ch 8: Queries

6 GIS and the U.S. Census

T 2/14	Census fundamentals and spatial data source Readings: • Peters, A. H. & MacDonald, H. I. (2004). *Unlocking the Census with GIS*. Redlands, Calif.: ESRI (Ch 1: The Census: An Introduction; Ch 3: Using the Census to analyze demographic and social conditions.) • Myers, D. (1992). *Analysis with local census data: Portraits of change*. Boston: Academic Press (CH 1: Using Census data for local portraits) • U.S. Census Bureau. (2014). Utilizing data from American FactFinder with TIGER/Line shapefiles in ArcGIS. retrieved from https://www2.census.gov/geo/pdfs/education/tiger/AFF_TIGERLine_Joining_Presentation.pdf
R 2/16	Using the American Community Survey Readings: • MacDonald, H. (2006). The American Community Survey: Warmer (more current), but fuzzier (less precise) than the decennial census. *Journal of the American Planning Association*, *72*(4), 491–503 • Peters, A. H. & MacDonald, H. I. (2004). *Unlocking the Census with GIS*. Redlands, Calif.: ESRI (Ch 3: Using the Census to analyze housing issues.)

7 Spatial Relationships and Spatial Joins

T 2/21	Readings:⋆⋆⋆ • Price, Ch 9: Spatial joins • Talen, E. (1998). Visualizing fairness: Equity maps for planners. *Journal of the American Planning Association*, *64*(1), 22–38

8 Map Overlay and Geoprocessing

R 2/23	Readings: • Price, Ch 10: Geoprocessing • Schlossberg, M. (2003, May). GIS, the US Census and neighbourhood scale analysis. *Planning Practice and Research*, *18*, 213
T 2/28	Spring Break
R 3/2	Spring Break

9 GIS Data Sources

T 3/7	Readings TBD

10 Principles of Geocoding

R 3/9	Readings: • Price, Canvas reading of geocoding chapter from previous edition • Drummond, W. J. (1995). Address matching: GIS technology for mapping human activity patterns. *Journal of the American Planning Association*, *61*(2), 240–251

11 Raster Analysis

T 3/14	Readings: • Price, Ch 11: Raster Analysis • Chang, K.-T. (2008). *Introduction to geographic information systems*. Boston: McGraw-Hill (Ch 13: Raster data analysis)
R 3/16	Readings:⋆⋆⋆ • Kar, B. & Hodgson, M. E. (2008). A GIS-based model to determine site suitability of emergency evacuation shelters. *Transactions in GIS*, *12*(2), 227–248 • van Haaren, R. & Fthenakis, V. (2011). GIS-based wind farm site selection using spatial multi-criteria analysis (SMCA): Evaluating the case for New York State. *Renewable and Sustainable Energy Reviews*, *15*(7), 3332–3340

12 Basic Editing

R 3/21	Readings: • Price, Ch 7: Basic editing

13 Geodatabases

R 3/23	Readings: • Price, Ch 13: Geodatabases • Winters, M., Brauer, M., Setton, E. M., & Teschke, K. (2013, October 1). Mapping bikeability: A spatial tool to support sustainable travel. *Environment and Planning B: Planning and Design*, *40*(5), 865–883

14 Metadata and Data Quality Issues

T 3/28	Readings: • Price, Ch 14: Metadata
R 3/30	Q & A for final project

15 Open Source GIS, Participatory GIS, and Future Directions

T 4/4	Readings:⋆⋆⋆ • Adams, D. (2013). Volunteered geographic information: Potential implications for participatory planning. *Planning Practice & Research*, *28*(4), 464–469 • Brown, G., Schebella, M. F., & Weber, D. (2014, January). Using participatory GIS to measure physical activity and urban park benefits. *Landscape and Urban Planning*, *121*, 34–44 • Drummond, W. J. & French, S. P. (2008, April 24). The future of GIS in planning: Converging technologies and diverging interests. *Journal of the American Planning Association*, *74*(2), 161–174
R 4/6	Readings:⋆⋆⋆ • Göçmen, Z. A. & Ventura, S. J. (2010, March 22). Barriers to GIS use in planning. *Journal of the American Planning Association*, *76*(2), 172–183 • Klosterman, R. E. (2008, April 24). Comment on Drummond and French: Another view of the future of GIS. *Journal of the American Planning Association*, *74*(2), 174–176
T 4/11	Open source tools

Final Project–dates subject to change

R 4/13	Draft poster fair

T 4/18	Potential Poster Fair Date Details TBA
M 4/24	Potential Poster Due Date Details TBA

Tentative Lab Schedule

Week	Dates	Work
1	1/5–1/6	No Lab
2	1/13–1/14	Price, Teaching Tutorial Ch 1
3	1/19–1/20	Price, Teaching Tutorial Ch 2
4	1/26–1/27	Price, Teaching Tutorial Ch 3
5	2/2–2/3	Price, Teaching Tutorial Ch 4, Ch 5
6	2/9–2/10	Price, Teaching Tutorial Ch 6
7	2/16–2/17	Price, Teaching Tutorial Ch 8
8	2/23–2/24	Price, Teaching Tutorial Ch 9
9	Break	
10	3/9–3/10	Price, Teaching Tutorial Ch 10
11	3/16–3/17	Price, Teaching Tutorial on Canvas (Geocoding)
12	3/23–3/24	Price, Teaching Tutorial Ch 11
13	3/30–3/31	Price, Teaching Tutorial Ch 7, Ch 8
14	4/6–4/7	Final project work
15	4/13–4/14	Final project work