Geography 5210: Fundamentals of GIS

The Ohio State University

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Lecture: 209 W 18th Ave 170, Mo We 12:40 - 1:35PM
Lab: Derby Hall 0140, Mo We 1:50 - 2:45PM
Course URL: http://carmen.osu.edu

This course introduces principles of geographic information systems and their applications in spatial analysis and information management. The course is designed to give students an understanding of cutting-edge geospatial technologies, their capabilities, uses, and limitations. Representative applications for each discipline area are demonstrated in the computer laboratory portion.

Textbook

We use the following two required textbooks:

- Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind. 2015. *Geographic Information Science and Systems*, 4th Edition. Wiley. (Both ebook and printed edition are fine.)
- Wilpen L. Gorr and Kristen S. Kurland. 2013. *GIS Tutorial 1: Basic Workbook, 10.1 Edition*. ESRI Press.

During the semester, various handouts will be made available either on the course website or during class. These handouts will be mainly used for in-class exercises and discussions.

Evaluation

Standard OSU grading scale will be used for evaluation. Grading will be based on four elements:

- Lab exercises (45%).
- Midterm exams (15%). There will be two midterm exams. These are closed book exams and only the materials covered in the time before each of the midterms will be used in the exam.
- Final exam (20%). This will be a comprehensive exam with an emphasis on materials after the second midterm exam. Some of the questions in the exams (midterm and final) will be

used to assess whether the overall goals of this course have been achieved. These are ungraded questions that will be embedded in the exams.
- Participation and exercises (20%). There will be plenty of in-class and take-home exercises/readings during the semester. Your participation in these activities will also be used to count your attendance. Among these activities, we will use case studies to understand a few important concepts during the semester. Instructions will be provided in class about these case studies and students are typically required to submit responses to a number of questions at the end of each class. There will also be numerous in-class exercises in which students will work on questions and submit their answers at the end of the classes. There is a take-home exercise on terrain that will be graded based on the correctness of the answer. Other exercises are mainly graded on the basis of completion.

Course Schedule

A tentative course schedule is available at here. Please check the web site frequently because materials listed in the schedule will be updated each week.

Computer Laboratories

We will use the geography computer lab in Derby 0140 to complete the labs. Lab reports are generally due in one or two weeks, as indicated in each lab assignment. There are five lab assignments. We will use the geography computer lab in Derby 0140 to complete these assignments. Lab assignments will include the following:

Lab 1. Introduction to ArcGIS. Using ArcGIS, students will become familiar with the ESRI ArcGIS software, explore different types of geodata available, and learn basic database operations. Specific objectives include learning how to use ArcGIS; the types of geodata in a GIS environment â€“ vector, raster and images; how to display data in ArcGIS.

Lab 2. Vector Data. Students will become familiar with various ways of handling vector data sets. Students will also explore a number of mapping techniques in ArcGIS and learn how to generate a meaningful map..

Lab 3. Geoprocessing. Using ArcGIS, students will become familiar with vector data operations. Specific objectives are to perform visual interpretations of vector data, learn vector buffer operations, and learn basic vector operations using the ArcGIS Geoprocessing wizard.

Lab 4. Raster Data and Operations. Using ArcGIS, students will become familiar with raster data and learn simple data manipulations in a raster system. Specific objectives are to understand and learn general aspects and display of raster data (grid dataset), map algebra/data reclassification, and raster buffer operations.

Lab 5. Projections. The purpose of this lab is to help students understand the important of map projections and geodetic datums. We will explore the impact of different datums on spatial data and how to convert between different projections.

Lab 6. Geodatabases. The purpose of this lab is to become familiar with data relationships in a GIS. Specific objectives are to (1) understand the relationships in datasets and attribute/spatial relations, and to learn the difference between a join and relate operation, and (2) learn the fundamentals of the geodatabase as a form of spatial data organization while exploring some of the built-in functionality including relationship specifications and connectivity and topology rules.

QGIS. This is a lab design the help students understand the advances in open-source GIS software packages. We pick a highly popular package and tour the many of the GIS tasks that we have introduced using the commercial package. We encourage students to take a closer look at the open-source movement in geospatial technology and possibly beyond and compare and contrast them with the commercial ones.

Final Project: Applications of GIS. Students will perform a spatial analysis exercise, given only the criteria to use for reaching a conclusion. Objectives are to explore a data set and the geographic distribution of the variables and to arrive at several conclusions. Other objectives include learning to design and perform the necessary data analysis in a vector-based or raster-based GIS. Data export utilities to other applications, such as Microsoft Access or Excel, will be learned for developing a more complete statistical analysis of spatial data.

Important Issues

Late papers. I will not accept any make-ups for in-class exams and exercises or quizzes. Exceptions may be granted in cases such as serious illness, family emergency, or career opportunities, but only if requests were made before the class or the missed event starts. In case submissions are required, instructions will provided and in no circumstances will email submissions be accepted. GTA's will have their policies regarding late submissions of lab reports.

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. **Plagiarism is wrong and should be prohibited.** Instructors shall report all instances of alleged academic misconduct to the Committee (Faculty Rule 3335-5-847). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/csc/).

Disability services. Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/.

Geography 5210: Course Schedule

This is a tentative schedule and it includes the dates of and links to lectures on data and operations, labs, case studies, and exams. More detailed descriptions about these components can be found at the course syllabus. The links in this schedule will be made available before class.

Week	Date	Topics	Readings	Labs
1	1/11	Introduction	1	Introduction to GIS
	1/13	Representations	3	
2	1/18	No class (MLK)		
	1/20	Case study: what is GIS?	1,+	
3	1/25	Vector data	2,7,8	Vector data
	1/27	Vector overlay	13	
4	2/1	Raster data	2,7,8	Geoprocessing
	2/3	Remote sensing	3,+	
5	2/8	Raster operations	13	Raster data and operations
	2/10	Other data models	3,7	
6	2/15	Midterm 1		
	2/17	Georeferencing	4	
7	2/22	Projections	4.8, 4.9	Projections
	2/24	Datums	4.7, 4.8	
8	2/29	Databases	9	
	3/2	Databases	9	
9	3/7	Digital data sets	+	Geodatabases
	3/9	Storage	+	
10	3/14	No class (Sprint break)		
	3/16	No class (Sprint break)		
11	3/21	Case study: Systems	10,+	
	3/23	Midterm 2		
12	3/28	Mapping	11	Final projects
	3/30	No class (AAG)		
13	4/4	Mapping	11	
	4/6	Case study: Mapping	11, 12, +	
14	4/11	Spatial autocorrelation	2.8	QGIS
	4/13	K-function	13.3.3	
15	4/18	Nearest neighbor distance	+	
	4/20	Interpolation and terrain	14.3	Take home exercise
16	4/25	Case study: GIS ethics	+	
17	5/3	Final (Tuesday 12-1:45 PM)		