GEOS 205: Introduction to GIS

MWF 1:40-2:50; T 9:40-11:30 AM
JSC 201 (Geoscience Mac Lab)

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What is GIS?

GIS stands for Geographic Information System, a generic term for any software application that is capable of viewing, overlaying, and manipulating geographic data. A GIS is much more than a simple mapping program. Most GIS packages (including the one we will be using) enable the user to perform complex transformations and spatial/statistical analyses upon spatial data, and to visualize these data in a variety of informative ways. GIS has applications in all branches of Earth and space science, biology, industry, government, business, engineering, and any endeavors for which analyses of spatial data are required.

ArcGIS software

Although there are many GIS packages available, the most widely used (and by far the most comprehensive) software package is ESRI ArcGIS. This is what we will be using for this class. The learning curve of ArcGIS is very steep, but because it is the industry standard for the forseeable future, experience using this software is very valuable in today's job market.

Expect everything you do using ArcGIS to take up to 1000 times longer than you think it will. This figure multiplies exponentially the nearer you get to a deadline according to the equation:

$$\text{Actual time spent} = [1000 \times \text{Time you thought}]^{1/\text{time before deadline}}$$

The point is: *workslowly, carefully and thoughtfully, and leave yourself plenty of time to complete assignments!*

Goals of this course

The primary goal of this course is not simply to teach you to use the software. That undertaking would not only be pointless (because software updates occur so regularly that this information would soon be out-of-date), but also futile: ArcGIS is simply too big to teach in its entirety over the course of one semester. Instead, the purpose of this class is to teach you the basic methods, concepts, and language of GIS so that you can easily adapt yourself to any GIS system.

The primary goals of this course are to:

1. Introduce you to overarching concepts in geography and display of geographic data;
2. Familiarize you with standard methods of spatial analysis and geostatistics;
3. Familiarize you with the types of data commonly used within GIS systems, their uses, limitations, and pitfalls;
4. Give you experience planning, developing, and presenting a GIS project using available data sources.

Course outline

This course consists of three main components: 1) lecture, 2) laboratory activities and homework, and 3) independent projects. Each week we will examine a new topic (see schedule for details). There will be several quizzes (dates TBA) that will test your mastery of the material.

Lecture

The lecture component of this course is geared to introduce you to concepts explored in the lab exercises. I will use a combination of PowerPoint presentations, demonstrations, and examples to teach you underlying concepts and the procedures for implementing them in ArcGIS.

Lab exercises and homework

The lab exercises in this course are designed to give you "hands-on" experience using the ArcGIS software (along with all of its quirks and pitfalls), while developing mastery of a particular concept. **Attendance is mandatory.** Homework will be assigned as needed to supplement concepts presented in lecture.

Exams and quizzes

There will be a quiz following each topic covered in this course. In addition, there will be two take-home exams where you will be required to solve several problems using ArcGIS.

Independent projects

You are required to complete an independent project using GIS in this course. Projects should include a spatial analysis of some kind (i.e. you need to generate *new data*, not just display map data you got from the internet!). You may choose any topic you like, as long as the scope is within reason and the analysis is rigorous. Project proposals are due September 20. See the attached schedule for other project related due dates.

You will work in pairs for these projects, but the final product you turn in should be yours alone. The final result should consist of:

1) A thematic map (or set of maps) that displays the results of your analysis; and
2) A written report (3000 words or less) that describes, in plain English, the procedures used, sources of data, an assessment of the viability of your analysis, and suggestions for further work or further data that could be used to refine your analysis. Your maps should be referred to as figures in the body of the text.

Your projects will be presented in poster form at the GIS Day exposition in the Julian atrium on the afternoon of **Wednesday, November 20**. This is the preliminary due date for your projects; you will be required to present (and defend!) your poster to visitors during this event. After GIS Day, we will discuss each project as a group to explore what could have been done differently (or better) in each project. You may use the comments you receive during this time to refine your individual project.

Course materials

The textbook for this course is:

Bolstad, *GIS Fundamentals, Third Edition.* Atlas Books, 2008. $40

This is the most useful, accessible, and inexpensive text for a GIS class at this level. Read it! In addition, the ArcGIS help file, available from the Help menu in ArcGIS and accessible from every dialog box or window in ArcGIS, is an excellent source of technical information. Use it! (RTFM)

Assessment

Your grades will be based upon the following criteria:

Participation, laboratory activities and homework:	30%
Exams and quizzes:	30%
GIS Day Poster/Final project:	40% (includes proposal and data)

A note about data storage and management:

You will all be provided with disk space on the I: drive under which to store data for this course. It is important to be organized, and to delete unnecessary files!

Technical Forum:

Please post problems (and solutions!) to the Technical Forum on Moodle. I will monitor this and respond to any requests for help.

GEOS 205 Schedule

The following is a rough schedule for this class that we will try to adhere to.

Week of:	Topic	Lab activity (Tues)	Reading	Other
Aug 28	Introduction, map basics	----------	Ch. 1	**Form Groups for Projects**
Sept 2	GIS data models	Creating a basic map with ArcGIS	Ch. 2	**Research topics**
Sept 9	Coordinate Systems	Projections	Ch. 3	**Research topics**
Sept 16	Data editing, transformation, and georeferencing	GPS data collection and georeferencing	Ch. 4, 5	**Project Proposals due (20th)**
Sept 23	Querying and classifying data	Data classification methods	Ch. 8	
Oct 30	Vector analysis	Geoprocessing tools	Ch. 9	**EXAM 1**
Oct 7	Raster analysis I	Derivations and cost analysis	Ch. 10	
Oct 14	Raster analysis II	Interpolation methods	Ch. 11,12	
	FALL BREAK: OCT 13-21			
Oct 28	NO CLASS- GSA	NO CLASS-GSA	---------	
Nov 4	Work on projects	Work on projects	---------	
Nov 11	Work on projects	Work on projects	---------	**No class Nov. 5-7 (GSA)**
Nov 18	Poster printing	Project discussion	---------	**GIS DAY, NOV 20**
Nov 25	Project discussion	**THANKSGIVING**	---------	
Dec 2	Remote sensing	Remote sensing	Ch. 6	**EXAM 2**
Dec 9	Remote Sensing	Spectral analysis	---------	

Final Projects Due Thursday, December 19, by noon.