

# GEO241: Geographic Information Systems I

Syllabus | Spring 2008-2009 | DePaul University

**1. Meeting:** Tue 5:45-9 PM at Schmitt Academic Center 224 (GIS Lab) in Lincoln Park Campus

## 2. Instructors

- Sungsoon (Julie) Hwang (shwang9@depaul.edu, 990 W Fullerton Room# 4513, Office hour: Wed 3-5 PM and by appointment)
- Brian McCormick (Lab assistant, brian\_3687@yahoo.com, Lab hour: TBA in GIS lab)

## 3. Course Overview

GIS is a computerized system designed to work with geographically referenced data. This relatively new field has developed over the last several decades, and it has increasingly become operational in our daily life (for example, GPS for navigation, remote sensing for weather forecast, computer mapping for managing natural resources and infrastructure). Three keywords may help you get a sense of what GIS is - (1) Location (2) Digital (3) Science and Technology. Throughout the quarter, the value of geographic information (i.e., information that involves locational aspect) will be demonstrated with numerous real-world examples. For instance, imagine you work with the computer system for disaster management, retail analysis, transportation planning, and climate change where information is organized spatially vs. where information is not organized spatially. Also, it is important to understand that GIS represents emerging stream of digital revolution. It means that you will get more educated on what it means to be digital, and whether it matters after taking this class. Finally, science and technology is the foundation of GIS knowledge. For instance, you will get to realize that subjects to be covered in this course (e.g., GPS, remote sensing, database, cartography, and spatial analysis) are built on math, science, and technology upon a closer look. In plain English, at the end of this course you should be able to argue more sophisticatedly why location matters, why digital matters, and how science and technology contributes to our understanding of the world.

This course will provide an introduction to this field. It will serve as a foundation to further works in this area (if you plan to pursue GIS career or want to get a GIS certificate). Students will be involved in numerous computer works, mainly GIS software (ArcGIS 9.3) in and outside of the class. Familiarity with computer and Windows-based software is not required, but will be helpful. LSP 120 (Mathematical and Technological Literacy I; formerly known as ISP120) or an instructor's permission is a prerequisite to GEO241.

## 4. Required Materials

- The text - Longley et al, 2005, Geographic Information Systems and Science, 2nd Edition, John Wiley & Sons (ISBN: 0-470-87001-X) available at college bookstore

- A portable USB drive with at least 50 Mb free space

## 5. Outlines of Course Contents

### Part I. Conceptual framework

- ❖ Introductions to GIS
- ❖ GIS applications
- ❖ GIS as software

### Part II. Understanding characteristics of geographic data

- ❖ Database concept
- ❖ GIS data model
- ❖ Data capture technology (remote sensing & GPS)
- ❖ Spatial reference system

### Part III. Adding value to geographic data

- ❖ Principles of cartography
- ❖ Methods of spatial analysis

## 6. Learning Goals

At the end of this course, you should be able to

- Recognize the potential of GIS in understanding and operating the world
- Elaborate on what geographic perspectives offer in enhancing our knowledge of the world
- Understand implications of information technology in understanding and solving geographic problems (e.g., climate change, disaster management)
- Be more proficient at quantitative reasoning applied to geographic problems

## 7. Grading Components

Midterm exam	15%	May 5 (unless noted otherwise)
Final exam	25%	June 9, comprehensive (cumulative) exam
Project	20%	Turn in report by June 11 through digital dropbox
Activities	10%	See tentative schedules for details
Labs	10%	See tentative schedules for details
Homework	10%	See tentative schedules for details
Participation	10%	

**Project:** You will learn to make maps to find out how much and where toxic chemicals are released in your home County using GIS. You should turn in a paper in which you address the spatial distribution of toxic release, processes you went through, and lessons learned from the class. You will be provided help with all steps necessary to complete the project. Steps consist of downloading spreadsheet data from EPA Toxic Release Inventory (TRI) Explorer website, formatting & geocoding the data to make it compatible with GIS, and making maps. Detailed guidelines are provided under Projects section in the Blackboard.

**Activity:** Learn GIS by doing. Most of activities are group works. Activities take place in the class, and your group's work will be collected on the day of activity.

**Lab:** Learn GIS software ArcGIS 9.3. All labs are expected to be completed in the class with the help of instructors.

**Homework:** All can be completed at home with internet access except for Homework4.

**Participation:** A sign-up sheet will be circulated to check attendance every class. Students are encouraged to participate in the class discussion. Individual participation will be taken into consideration when grades are finalized using curve whenever applicable.

More details are given in tentative schedules below.

## 8. Tentative Schedules

<i>Date</i>	<i>Topic</i>	<i>Reading</i>	<i>Related work</i>
March 31	Course overview	Syllabus	
April 7	Introduction to GIS GIS applications	Longley (text) 1.1-1.5 Longley 2.1-2.2	Activity 1 Homework 1
April 14	GIS as software Database concept	Longley 7.1,7.2, 7.6 Longley 10.1-10.3	Lab1 Project stage 1
April 21	GIS data model Data collection	Longley 3.1-3.7, 8.1-8.2.3 Longley 9.1, 9.2, 5.8, 5.9, 9.4	Lab2 Homework 2
April 28	Georeferencing Earth coordinates Map projection	Longley 5.1-5.4 Kimerling 2005a Longley 5.7	Activity 2 Activity 3
May 5	<b>Midterm exam</b> Geocoding	Longley 5.9 (technical box 5.3)	Project stage 2
May 12	Nature of map Cartographic design	Kimerling 2005b Slocum 2005, Dent 1999	Activity 4 Lab3, Homework 3
May 19	Query and measurement Overlay and buffering	Longley 14.1-14.3 Longley 14.4.1-14.4.3	Activity 5 Lab 4
May 26	Spatial interpolation Project help	Longley 14.4.4	Lab 5, Homework 4 Project stage 3
June 2	Project help		Project stage 3
June 9	<b>Final exam</b>		
June 11	<b>Project report</b>		

Reading materials other than the text are provided under Readings section in the blackboard

### Detailed plans of each class

March 31: You will be introduced to GEO241 today. We will address questions like what GIS is, and what you expect to learn from GEO241. Homework 1 (GIS case studies) will be circulated.

April 7: We will begin with several fundamental concepts that help you conceptualize GIS, namely characteristics of geographic problems and the sequence of data-information-knowledge. You as a group will discuss bases of classifying geographic problems (Activity 1). You will get a brief survey of GIS with a focus on history and trends in industry. After GIS applications are reviewed, you will have a chance to talk about GIS case studies (Homework 1) you have conducted. It is possible that a guest speaker from UW-Milwaukee will talk about the application of GIS to bike route planning today.

April 14: GIS is software which runs on different platform and interface. Some useful knowledge that helps you understand GIS as software will be introduced before you get started with Lab 1 (introduction to ArcGIS). Then we will discuss fundamental database concepts which are important to understand inner workings of information technology in addition to software. After getting an overview of project (toxic mapping project of your home county), you will begin to work on the first phase of project; you will download spreadsheet data that contains characteristics and locational information of facilities that release toxic chemicals in your home county from EPA Toxic Release Inventory (TRI) Explorer website, and format the data such that they can become compatible with GIS.

April 21: GIS data model can be thought of as computer's way of representing spatial things. Think of lake drawn on a paper map, and how this will be encoded as digital constructs. There are two fundamentally different ways of digitally encoding geographic entities – vector and raster. Lab2 will get you have a hands-on look at vector and raster. You may have wondered where geographic data in Google Earth and mapquest come from and how they are made to the system. We will talk about primary sources of geographic data; they are usually captured through technology such as remote sensing and Global Positioning System (GPS). Brief introduction to remote sensing and GPS will be provided in the context of GIS. Homework 2 to be due next week will be circulated.

April 28: Geographic data by definition is the data located somewhere on the Earth. You will essentially learn about methods of referencing location on the Earth such as Latitude & Longitude. Unlike what you learn from elementary school about geographic coordinate system (where Earth is seen as a perfect sphere and parallel & meridian are drawn in a clear-cut fashion), understanding how the Earth's location is referenced is quite complicated if you choose to be picky because making a precise map requires accurate measurement of Earth's dimension (earth is not a sphere by the way), and sensible choice of map projection (flattening the Earth to flat surface which involves necessary distortion). We will put together all to make sense of spatial reference system used in professional settings such as USGS topographic map, military applications, and land record & utilities maps in municipalities. At some point, we will go out to collect Earth coordinate data using a GPS receiver (Activity 2), and explore different map projection in ArcGIS (Activity 3).

May 5: After the midterm, we move on to the second phase of project. It means that you should bring the result data from the first phase of project earlier. This involves geocoding the spreadsheet data; geocoding basically translates tabular data to geographic data by matching locational information provided in tabular data (e.g., street address, Latitude & Longitude) against reference data (such as street data). As you know, google map and mapquest is partly geocoding service in that they map where things are. GIS specializes in this function, and we do this in a more various fashion.

May 12: The first thing that would come to most people's mind when they hear GIS would be a map. Early days of GIS were almost equated with computer mapping. We begin with discussing defining characteristics, and typology of maps to give you a context, and then we will put major effort on designing thematic maps. It would probably work like a role playing – what if you're a cartographer and are asked to produce let's say the world AIDS map? What should you take into consideration? Similarly, how would you go about making toxic maps in your home county (Homework 3)? With Activity 4, you are making some thematic maps, and will discuss how data measurement affects visuals. Lab3 steps you through making a professional quality maps in ArcGIS. If I have to pick one class you should never miss in GEO241, it would be today's class.

May 19: Spatial analysis is a very convenient tool that helps you get answers to geographic entities quick under many circumstances – for instance if you want to know which hospitals are within 1 miles from your place (query), measure the size of buildings or land parcels (measurements), identify a new site suitable for landfill (overlay), and know who live near a retail store or river (buffering). You should bring result data from the second phase of project (in other words, geocoded data) to complete Activity 5. With Lab 4, you will identify and summarize snail habitat affected by vehicle emissions by applying methods of spatial analysis mentioned above.

May 26: It is often the case that you need to estimate data value from sample data (such as temperature, ozone level, pH level in soil, concentration of air pollutants) because the whole array of measured values are not available. You will learn inverse distance weighting (spatial interpolation method) to get a sense of how those unknown values are estimated. With Lab 5, you will make a smooth surface map (like temperature maps on TV) that depicts radioactivity level and thyroid cancer rate in Belarus to investigate the aftermath of Chernobyl meltdown in 1984. Spatial interpolation is the prerequisite to making those so-called isoline maps. Help for homework 4 will be provided through which you should make toxic maps.

June 2: Any help for project will be provided in the class.

June 9: Final exam will take place in GIS lab during the same hour as the class meeting.

June 11: Turn in final project report through digital dropbox.

## **9. Miscellaneous**

### GIS Lab

Printing policy: Students can print out up to 100 pages upon DePaul ID verification

Operation hours: 9-9 M-Th, 9-5 F, and 12-4 Sat/Sun

Access policy: Students can use equipments in GIS lab during operation hours. However, GIS lab is occupied by quantitative reasoning classes most of the time. Therefore, students are advised to check class schedules posted on the door before the visit. Class schedule can be also viewed in the blackboard (under SAC224 schedule tab).

If you have any technical difficulties in GIS lab which is not related to generic GIS problems (e.g., access to X drive, errors in printing account), please contact a QRC lab manager Jennifer Galka by phone (773) 325-4663 or by e-mail [JGALKA1@depaul.edu](mailto:JGALKA1@depaul.edu). Her office is located in QRC (SAC 268).

### Grading Scale

Points earned	Letter grade
93-100 points	A
90-92.99 points	A-
87-89.99 points	B+
83-86.99 points	B
80-82.99 points	B-
77-79.99 points	C+
73-76.99 points	C
70-72.99 points	C-
50-69.99 points	D
< 50	F

### Academic Integrity

Work done for this course must adhere to the University Academic Integrity Policy, which you can review in the *Student Handbook* or by visiting <http://studentaffairs.depaul.edu/homehandbook.html>.

## 10. Frequently Asked Questions

1) Where and when can I use GIS software?

Name	Location	Hour	# Computer
GIS Lab	SAC 224	Check the door	27
Quantitative Reasoning Center	SAC 268	Check the door	27
Database search room	Richardson	Same as library hour	2

2) Can I have ArcGIS installed in my personal computer?

Yes. Order 60-day evaluation copy at [www.esri.com/software/arcgis/arcview/eval/evalcd.html](http://www.esri.com/software/arcgis/arcview/eval/evalcd.html). The CD will be delivered to you at no cost. Expect more than two weeks to receive the CD. Julie also has several evaluation copies of old versions ready to be given away. Note that evaluation copy does not come with extensions such as Geostatistical Analyst, and does not work in Mac.

3) What if I couldn't finish labs with given time in the class?

Chances are that you're a slower learner when it comes to computer. If you can't complete labs in time, you are expected to do remaining work on your own outside of the class. For help outside of the class, contact a lab assistant or take advantage of his lab hours to be announced through Blackboard e-mail system weekly.

4) What is the policy on late works?

Late works will be accepted with a penalty of 20% of points assigned to each work per day. For example, you're late five days, you won't get any score. You can submit the work by e-mail whenever applicable. If it is a hard copy, submit it to Geography Department office (990 W Fullerton Suite 4300). If no one is around the office, put it in my mailbox under Julie Hwang.

5) I couldn't attend the class or submit the work on time for some understandable reasons (e.g., illness, family emergency). Is there any way to make up for this?

Yes. I will make up for your absence or late work provided that you (1) notify me in advance whenever possible (2) present some tangible evidences in a timely fashion. Examples of tangible evidences include doctor's note on appointment, prescription, a copy of e-mail correspondence with those involved, and pictures of your being present in hospital with a date clearly marked.

5) What is the policy on makeup exams?

You can take makeup exams only when your case is deemed to be excusable. Let an instructor know in advance (at least one week before the exam if known). It is required that you provide evidences whenever applicable.

6) What is the policy on granting incomplete?

No incomplete grade will be granted unless dire situation (e.g., family emergency, sickness) arises toward the end of the quarter when other options (such as drop) are exhausted.

7) I lost my USB drive. Is there anywhere to look for my USB drive like lost & found?

Yes. It's most likely that your flash drive is at QRC (SAC268) unless it's already stolen. Contact a QRC lab manager, Jennifer Galka.

To help her identify who a lost flash drive belongs to, I suggest that you put a word document called "Open if Lost" in the main directory of your flash drive. In the document, you can put your name and an e-mail address so that you can be contacted in case the flash drive is found.