GEO 441: GIS for Community Development

Cross-listed with MPS 552

Winter Quarter 2019 | Department of Geography | DePaul University

Online Course

Important note for a Mac user: ArcGIS (GIS software) is NOT supported on an Apple computer. Although there are ways to use ArcGIS in an Apple computer, there are many technical issues to get around. Reach out to the GIS Coordinator, Cassie Follett at cfollett@depaul.edu for resources on running GIS software on a Mac or Linux computer. Installing ArcGIS on an Apple computer may take at least several hours depending on how familiar you are with computers and concepts like formatting, boot order, etc. As an alternative, you can borrow a PC for the course term or come to the campus.

1. Course Description: This course introduces GIS with focus on its applications to community studies and community development. GIS, computer-based systems for solving spatial problems, have been widely used in many applications including disaster response, public health, crime analysis, market analysis, archeology, environmental modeling, and much more. The course covers GIS fundamentals. Topics include geospatial coordinate systems (datum, map projection), data capture (GPS, remote sensing, etc.), data models (vector, raster, relational database), map design, and spatial analysis. Course contents are aligned with Geospatial Technology Competency Model (GTCM). The class is accomplished through lectures and hands-on activities. Lab activities will be focused on learning basic skills for using ESRI ArcGIS Desktop. The course will explain how GIS works; enable students to learn techniques including mapping, spatial analysis, and data management; and provide students with the opportunity to apply GIS to community development.

2. Instructors' Contact and Office Hours

	Instructor	Teaching Assistant	GIS Coordinator
Name	Sungsoon (Julie) Hwang	Nora Bryne	Cassie Follett
Contact	shwang9@depaul.edu (773) 325-8668	nbryne@gmail.com	CFOLLETT@depaul.edu (773) 325-3267
Where	990 W Fullerton, 3133	990 W Fullerton 3135 (990 GIS Lab) unless noted otherwise	990 W Fullerton, 3134
When	T/TH 2-3 pm or by appointment	Mon: 12-1:30p in 14 E Jackson 1327 Mon: 4-5:30p & Wed: 3-6 pm	when technical issues arise in 990 GIS Lab

3. Course Topics: through this course you will learn

- What GIS is, and how GIS has been and can be used in community development
- How coordinate systems for GIS are defined, including datum and map projections
- Where data for GIS come from, how spatial data are created, and where to get those data
- How data for GIS is structured and organized in a computer
- How to design and make effective maps
- How to conduct basic spatial analysis, including buffering, overlay, and query

4. Learning Outcomes: with the completion of each module of GEO 441, you should be able to

- Enumerate what you can do with GIS in various application areas
- Use common coordinate systems appropriately, including Geographic Coordinate System (GCS), Universal Transverse Mercator (UTM) and State Plane Coordinate System (SPC)

- Differentiate types of resolution that characterize remotely sensed imagery
- Assess strengths and weaknesses of data models representing geography
- Perform SQL selection query and table join on attribute tables in GIS software
- Articulate effects of data representation on thematic maps
- Employ cartographic design principles to make maps suited to a given problem
- Identify and assess suitable areas given multiple criteria using appropriate spatial analysis tools
- Use GIS appropriately to address an issue related to community development

5. Required Text

John Jensen & Ryan Jensen (2012) *Introductory Geographic Information Systems*, Pearson (ISBN: 978-0136147763)—this is required and available at the college bookstore in LPC (2425 N Sheffield Ave).

6. Outlines of Topics and Schedules (Important Due Dates)

Wk	Date	Topic	Reading	Activities (due Friday)	Homework (due Monday)
1	1/5-1/11	**1. Introduction to GIS**	Ch1	**Lab1**. Introduction to ArcGIS (due 1/11)	
2	1/12-1/18	**2. Coordinate system**	Ch2	**Lab2**. Plot XY data and project maps (due 1/18)	
3	1/19-1/25	**3. Data capture**	Ch3	**Lab3**. Classify remote sensing data (due 1/25)	
4	1/26-2/1	**4. Database**	Ch5	**Lab4**. Work with attribute table (due 2/1)	**HW1** by 1/28
5	2/2-2/8	**Midterm** on 2/4-2/5 (T)			
6	2/9-2/15	**5. Cartography**	Ch10	**Lab5**. Make thematic maps (due 2/15)	**HW2** by 2/11
7	2/16-2/22	**6. Spatial analysis**	Ch6	**Lab6**. Conduct site suitability analysis (due 2/22)	**HW3** by 2/18
8	2/23-3/1	Work on proposal		**Proposal** by 3/1	**HW4** by 2/25
9	3/2-3/8	Work on project		Work on project	
10	3/9-3/15	**Final** on 3/11-3/12 (T)		Work on project	
11	3/16-3/22	**Paper** on 3/19 (T)			**MOM** by 3/22

Time Requirements: You should be prepared to spend approximately 7-10 hours each week to read a text (2+ hrs.), review course materials (2+ hrs.), and complete hands-on activities (2+ hrs.), homework, and project.

7. Grading Components

Components	Points out of 100 points
Participation (review questions, self-assessment, discussion, etc.)	14 points
6 lab activities (each 3 points)	18 points
4 homework (each 4 points)	16 points
Exam (midterm 10 points, final 10 points)	20 points
Project (Proposal 4 points, and Paper 22 points)	26 points
Map of the Month	6 points

Grading Scale: A 93-100%; A- 90-92.99%; B+ 87-89.99%; B 83-86.99%; B- 80-82.99; C+ 77-79.99%; C 73-76.99%; C-70-72.99; D+ 60-69.99%; D 50-59.99%; F 0-49.99%

Review questions: review questions are provided for mindful and focused reading, and to prepare you for lectures. Type and submit answers to review questions after completing readings assigned to each module. Review questions can be submitted anytime during a week assigned for each module. Review questions will be graded based on timeliness and thoughtfulness.

Self-assessment: quiz questions for self-assessment are provided to assist you in comprehending key points made in lecture notes/videos. You can make multiple attempts to answer self-assessment questions. Your efforts and scores are tracked for grading. Make sure you answer all questions correctly by clicking "Check Answer" and checking points scored for all questions to earn the maximum points. Self-assessment can be submitted anytime during a week assigned for each module.

Discussions: there will be two discussions. You will need to (1) write responses to the Geospatial Revolution video during week 1 and (2) discuss your project idea and any issues during week 7 (before submitting proposal on week 8). Discussion will be graded based on whether you posted your responses, and you replied to peers' responses.

Lab activities: the best way to learn GIS is by doing. Lab activities will teach you basic ArcGIS skills while helping you make sense of any new concepts you learned. There will be two or more questions to answer in each hands-on activity. Follow instructions carefully and understand what you're doing to answer those questions correctly. If you can, show up in 990 GIS Lab during instructors' office hours and work with other peer students. That way you can troubleshoot any problems almost immediately.

Homework: homework provides another opportunity to apply GIS skills to a new problem set. You need to complete relevant lab activities successfully before working on homework in each module.

- HW #1 (point mapping): make a point map by turning a delimited text file with XY coordinates into geospatial data. You should complete module 1 and module 2 (coordinate system) before HW 1. This assesses whether you can choose appropriate geodetic datum and map projections for a given geographic area of interest.
- HW #2 (data acquisition for GIS project): review GIS case studies that interests you. Identify and acquire data that might be used for the project you will propose. Document characteristics of the data by exploring data in ArcGIS and/or reading metadata. You should complete module 3 (data capture) before HW 2. This evaluates whether you can identify and assess data appropriate for a proposed GIS project.
- HW #3 (census mapping): make a thematic map by joining an attribute table to spatial data. You should complete module 4 (database) before HW 3. This assesses whether you comprehend key concepts of relational database and perform table join.
- HW #4 (toxic mapping): make a thematic map that visualizes the amount of toxic chemicals released from the EPA's Toxic Release Inventory (TRI) facilities in your home county. You should complete module 5 (cartography) before HW 4. This will assess whether you can apply cartographic principles to map-making appropriately.

Exams: Exams will be open on D2L during days scheduled for exams. Exams are not cumulative. The midterm exam (week 5) covers module 1, 2, and 3. The final exam (week 10) covers module 4, 5, and 6. The exam can be completed anytime during those days scheduled for exams. The actual time to take the

exam is two hours. Exams are drawn from readings, review questions, lecture videos, self-assessment, and lab activities. The format of exams consist of true/false, multiple choice, short answer (one or two words), and short written responses (a paragraph). Only single attempt can be recorded. No ArcGIS skills are tested in the exam. A reminder for an exam will be emailed in advance.

Project: propose and conduct a GIS project that (1) demonstrates comprehensive use of GIS knowledge & techniques (i.e., drawing from at least two modules); (2) uses empirical data; and (3) addresses an issue related to community development. Topics of GIS projects in the previous quarters include green roofs and energy usage, food desert, health impacts of hazardous waste sites, vacant spaces in Chicago, crop suitability in Africa, global disease and poverty, and quality of life in Canada Provinces. Detailed instructions for project proposal and report (paper) will be provided on D2L.

Late Work Policy: Late work will not be accepted. Extensions can be requested if needed, but will be only granted under understandable circumstances.

Makeup Exam/Incomplete Grade Policy: A makeup exam or an incomplete grade can be arranged or granted only when credible dire and documented medical or family situations arise and these circumstances are communicated in a timely fashion.

8. Access to ArcGIS

Digital Student License: If you're enrolled in a GIS class at DePaul University (that has an ESRI site license), you can download and install ArcGIS Desktop on a personal computer for free. The instruction for this process (which will easily take an hour) is posted on D2L. Authorization codes used for installation will be updated every academic year, and so you can reach out to a GIS coordinator for new authorization codes if needed. ArcGIS is only supported in a Windows computer.

Labs with ArcGIS Desktop: SAC GIS lab (SAC 224), SAC 268, 990 GIS lab (990 W Fullerton, Room# 3135), Richardson Library, Loop Library, Daley 1327

GIS Lab Open Hours

- 990 GIS Lab (990 W Fullerton, Room# 3135): https://las.depaul.edu/academics/geography/geographic-information-systems-certificate/Pages/gis-lab.aspx or the lab door.
- SAC GIS lab (SAC 224): http://qrc.depaul.edu/hours.htm or the lab door.

DePaul Virtual Lab: you can access ArcGIS Desktop in both PC and Mac remotely at http://vlab.depaul.edu. There is no need for installing ArcGIS, but experiences may not be smooth as ArcGIS is computationally intensive. At least 8 Mbps is required for internet speed. There is a known issue with saving files from ArcGIS Desktop through Virtual Lab in an Apple Computer. Reach out a GIS coordinator if you encounter this issue.

9. Miscellaneous

Attendance/Absentee Policy: Consistent with university's policy, all students are expected to attend class meetings. Unless absence is explained on medical or compassionate grounds (documentation is required), absence from any classes is grounds for a grade adjustment.

Academic Honesty and Plagiarism: Academic honesty and integrity are expected at all times. Academic dishonesty, such as cheating or copying during exams, will be punished severely. Plagiarism – using someone else's work without acknowledgment and, therefore, presenting their ideas or quotations as your own work – is strictly forbidden. DePaul University officials will be informed of any instance of academic dishonesty and notification will be placed in your file. Please read the DePaul Academic Integrity Resources page (http://academicintegrity.depaul.edu/Resources/index.html) for definitions and explanations of plagiarism and the University's Academic Integrity expectations for students. Cutting and pasting text taken directly from a web-site without appropriate referencing and quotation marks is plagiarism and is forbidden. Submitting work that has any part cut and pasted directly from the internet is grounds for an automatic grade of zero.

University Center for Writing-Based Learning: Collaborates with writers from all disciplines, backgrounds, levels of expertise, and roles within the University community. Their goal is to help develop better writers along with better writing and reflection through continual revision. If you need assistance with writing assignments, they can be contacted at: 773.325.4272 (LPC) or wcenter@depaul.edu

Universal Design for Learning: GEO is committed to helping students achieve their full potential by removing barriers to learning and making reasonable accommodation when appropriate. Please help us by identifying barriers and suggesting ways we can diminish or remove them.

Students with special learning needs, or who are in circumstances which necessitate special consideration, must contact the instructor at the beginning of the course or earlier. Students with a documented disability who wish to discuss academic accommodations should contact the instructor as soon as possible and immediately contact the DePaul University's Office of Students with Disability at http://studentaffairs.depaul.edu/studentswithdisabilities/.

Please note: All university employees must report to the Title IX Coordinator all relevant details about any incidents of sex discrimination, including sexual harassment and sexual or relationship violence, of which they become aware. DePaul employees are also mandated reporters under the Illinois Abused and Neglected Child Reporting Act [325 ILCS 5/4]. If you need to speak directly with a Title IX Coordinator, email titleixcoordinator@depaul.edu.

10. Department of Geography Learning Goals

Courses in the Department of Geography teach students—GEO 441 addresses goals #1, 5, and 7:

1. Understand spatial patterns and processes of modification of the Earth's physical and cultural landscapes
   (a) As social constructions.
   (b) As systems that link the Earth with human society in interdependent, dialectical relationships, and
   (c) Through mapping and visualization.
2. Understand the concept of scale as a spatial phenomenon that ties the local, the regional, the national, the transnational, and the global in a system of interaction.
3. Understand the phenomenology of the discipline of Geography—most importantly, "space", "place", "landscape," "region," and "location".
4. Distinguish that spaces, places, and so on, may have both objective and subjective/symbolic dimensions.
5. Develop research and writing competences that would allow you to:

(a) Formulate a cogent research question about the spatial character of a physical, socio-cultural, or environment-societal phenomenon,
(b) Write about it in ways that reflect analytical and critical thinking, and
(c) Ethical concern over social and environmental justice, consistent with the University's social mission.

6. Engage competently in qualitative and quantitative spatial analysis, and with exercises that are concerned with explaining spatial regularities (for example, the spatial calculus behind the location of retail commerce in Chicago, or transnational flows of capital).
7. Learn the basic utility and use competently one or more of the information technologies that are now redefining the logistical limits of spatial analysis: geographic information systems (GIS) and remote sensing.
8. Achieve greater general knowledge of the world, its regions, its physical systems, its cultures, and political-territorial divisions.

11. GEO 441 Learning Objectives by Module—at the completion of GEO 441, you should be able to

Module 1. Introduction to GIS

- Compare and contrast GIS to other similar tools
- Articulate how GIS is used to leverage different forms of capital for community development
- List commonly used functions in GIS along with relevant real-world applications
- Get familiar with user interface and basic functionality of ArcGIS Desktop

Module 2. Coordinate reference system

- Describe what datum is
- Describe what map projection is
- Describe Geographic Coordinate System (GCS)
- Describe Universal Transverse Mercator (UTM)
- Describe State Plane Coordinate (SPC) System
- Map a delimited text file with XY coordinates and display different parts of the world using appropriate map projections

Module 3. Data capture

- Describe where data for GIS come from and how spatial data are created
- Explain how GPS determines position
- Identify real-world applications that use GPS
- Differentiate four types of resolution of remote sensing (temporal, spatial, spectral, radiometric)
- Enumerate real-world applications that use remote sensing

Module 4. Database

- Describe how vector and raster represent spatial features in GIS differently
- Explore geospatial data in different data format
- Describe how attribute data are stored (relational data model)
- Format unstructured data such that it conforms to a relational data model
- Work with attribute tables, including attribute query, field manipulation, and table join

Module 5. Cartography

- Describe how different thematic mapping techniques work
- Describe how different data classification methods work

- Articulate appropriate uses of visual variables (symbolization scheme) in map-making decision
- Discuss principles for organizing thematic content in map-making
- Apply principles of map design to various map-making scenarios

Module 6. Spatial analysis

- Perform spatial query on vector data
- Describe how different overlay techniques work
- Describe how inverse distance weighting works
- Discuss appropriate uses of map algebra
- Conduct suitability analysis using both vector and raster operations