Course Home

Geographical Information Science

Department of Geography
Indiana University-Purdue University, Indianapolis

FALL 2012

Instructor: RUDY BANERJEE, PHD

Associate Professor and Director of Graduate Studies

Course Meeting Times

Lectures:
One session / week
3.0 hours / session

Level

G338 Undergraduate/G538 Graduate

Office Hours:

Tuesdays 4:30 p.m. – 6:00 p.m.
CA 207D
Or by appointment

Teaching Home Page

https://oncourse.iu.edu/portal

Credit Hours

3.0

Feedback

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Course Description

Introductory and Intermediate topics in geographic information science and spatial analysis using GIS software. Introductory course for upper-division undergraduate and graduate students seeking greater understanding of GISc theory, technology, and applications. Exercises focus on development, management, and analysis of GIS data. (Lecture/Lab).

Course Objectives

The objectives of this course are five:

- Designed as the precursor to the advanced course in GISc (G438/539), G338/538 introduces understanding of geographic information science theory and spatial analysis methodologies. The course places a strong emphasis on building hands-on skills as well as theoretical knowledge in geographic information and spatial analysis. Each class meeting is comprised of a lecture and laboratory portion. Journal articles and online lecture materials are used to build understanding in geographic information science theory and application. Lab assignments focus on building skills and knowledge important for modern geographers and students of other disciplines who incorporate GIS technology in their research.
- To explore the foundations of Geographic Information Science (GISc) and Engineering (related mathematical and/or statistical theory) at a level and depth appropriate for someone aspiring to study higher-level applied science and/or to become a professional Geographic Information Scientist.
- To present an introduction to the field of topology, with emphasis on those aspects of the subject that are basic to spatial analysis and GISc.
- To introduce the student to what it means to do advanced GISc such as spatial analysis, as opposed to learning about spatial analysis or to learning to do exercises.

- To help the student learn how to write GISc and spatial analysis text according to the standards of the profession.
- To develop competence in handling large multivariate spatial analysis.

Prerequisites

None

Nature of the Course/Course Format:

Each class meeting is comprised of a lecture and/or laboratory portion. Journal articles and online lecture materials are used to build understanding in geographic information science theory and application. Lab assignments focus on building skills and knowledge important for modern geographers and students of other disciplines who incorporate GIS technology in their research.

Facilities and Software:
Each class meeting will occur in the Social Science Computing Classroom (SSCC), Cavanaugh Hall Room 436.

Open lab hours for the SSCC can be found at the following URL: http://jafar.indysla.iupui.edu/sscc/ Follow the link for "Classes" to see the lab calendar [**http://liberalarts.iupui.edu/cgi-bin/webcalng/webcalng.pl?op=month&calendar=CA436**]

Some faculty will permit students from other courses to use the lab during class times as long as there are extra seats available and the student does not interrupt the classroom. Contact the instructor before hand to verify that you will be permitted to use the lab during scheduled class times.

- Selected journal articles and excerpts from a variety of texts illustrating GIS theory and applications constitute the primary reading material. These will be provided by the instructor either in hard copy form or through reference to electronic resources.
- Students should purchase some form of media on which to back up their data. Available hardware in the SSCC includes CD/RW drives, and USB ports. As an alternative, material could also be backed up on a network account (like Google Docs or DropBox). ***It is strongly recommend that you regularly back up your data (at the conclusion of each class meeting), making TWO back up copies in case of media failure.*** Use of flash drives is encouraged.
- **Students are solely responsible for managing their data.**
- **Aside from class meeting time, data cannot be stored on hard drives of the computers in the SSCC; these are purged regularly.**

Evaluation:

Examinations
Exams include a combination of short essay questions, quantitative problems, and interpretation tasks. Exam content emphasizes theory and application covered in lectures, assigned readings, and laboratory exercises - there are no hands-on computer components to exams. Exam dates are finalized at least two weeks in advance. In general, they will occur at the middle and end of the semester (the 2nd exam is not cumulative). "Make-up" exams will not be given. Notify the instructor at least one week in advance of a scheduled exam date if an alternative date is necessary.

Exercises

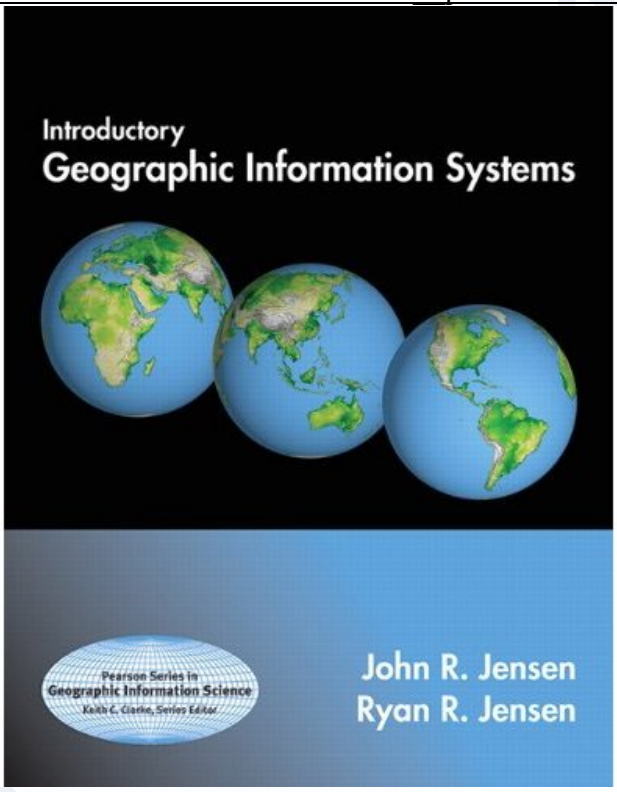
The laboratory portion of the course will consist of a series of 10 or 11 exercises. A significant portion of each class meeting will be reserved for students to work on laboratory assignments (usually 1/2 of each class meeting or more). Depending upon the pace of the course, there are also one or two open lab sessions scheduled during class time. Extra time will be required to complete exercises in addition to lab time provided during class hours. In other words, you will need to come to the lab to complete assignments outside of scheduled class time.

Submission of assignments in DIGITAL FORMAT format compulsory.

[**MS Word format** only]

Required TEXT: Please try to use digital version only.

http://instructors.coursesmart.com/9780321675736?__professorview=false&__hdv=6.8



An optional textbook is suggested for those who require additional introductory GIS.

C P LO and ALBERT K W YEUNG (**2002**). **Concepts and Techniques of Geographic Information Systems**. Prentice Hall, Upper Saddle Creek, NJ, 1002 . 492pp. ISBN 0-13-080427-4

Class Policies:

Student Responsibilities - Students are expected to abide by the rules and regulations of Indiana University. In addition to general University policies, students in this course are expected to attend every class, take lecture notes, review assigned readings before class, complete assignments and examinations on time, and participate in class discussion.

Attendance - We will be covering a large amount of material and the majority the subject matter on which you will be tested will be emphasized in lectures.
In addition, completion of advanced lab assignments will require you to call upon theory and techniques covered in previous classes. Consequently, your success in this course will depend greatly upon your attendance. **Perfect attendance is strongly recommended.** Students, who miss two consecutive classes, should notify the instructor and provide an explanation. Otherwise, students will be contacted by the University and be required to document that they have not unofficially withdrawn from the class.

Academic Honesty- Students are encouraged to help each other in their work during lab sessions. Procedures such as copying basic data may be necessary. If you find something interesting, share it with your classmates. However, final products as turned in to the instructor must display evidence of individual initiative and creativity. It is assumed that students taking this class will live up to the highest levels of academic honesty. Cheating or plagiarism will result in a final grade of F.
http://www.life.iupui.edu/conduct/ http://www.life.iupui.edu/conduct/
http://www.life.iupui.edu/conduct/code/

Liability Warning - Students are responsible for all activities on their computer accounts. Keep your user name and password confidential.

Expectations

We will deal with materials in lectures and exercise sessions since all materials cannot be in the text. The technological and theoretical aspect will be comprehensively covered but students are not expected to know anything about spatial analysis.

Each individual should provide all exercise solutions. In addition, graduate students should submit a final project in a portfolio format at the end of the semester. This will satisfy the professional requirements of working in a comprehensive GISc environment. Exercises will be evaluated to determine grade. Exams grades will guarantee whether one has mastered the concepts.

Optional problems will be provided for those intending to use knowledge acquired in this course to help with their dissertation.

Grading

Grading will be, as follows:

ACTIVITIES	POINTS
Problem Sets/Exercises	100
Midterm Exam	100
Final Exam	100
Student Project	50 pts.
Graduate Final Grade	**Total/350**

Grading Scale:

Letter of Points	Percentage Grade Earned
A+	97-100
A	93-96
A-	90-92
B+	86-89
B	83-85
B-	80-82
C+	76-79
C	73-75
C-	70-72
D+	66-69
D	63-65
D-	60-62
F	< 60

Principles of Undergraduate Learning (PUL) Objectives:

The PUL objectives addressed by this course include:

1. Core Communication and Quantitative Skills

Definition: The ability of students to write, read, speak and listen, perform quantitative analysis, and use information resources and technology--the foundation skills necessary for all IUPUI students to succeed.

Outcomes: This skill is demonstrated in this course by the ability of students to:

- comprehend, interpret, and analyze texts
- solve problems that are quantitative in nature
- make efficient use of information resources and technology for personal and professional needs

2. Critical Thinking

Definition: The ability of students to analyze carefully and logically information and ideas from multiple perspectives.

Outcomes: This skill is demonstrated in this course by the ability of students to:

- analyze complex issues and make informed decisions
- synthesize information in order to arrive at reasoned conclusions
- evaluate the logic, validity, and relevance of data
- solve challenging problems
- use knowledge and understanding in order to generate and explore new questions

Accreditation Board for Engineering and Technology (ABET) Objectives:

The ABET objectives addressed by this course include:

- demonstrating appropriate mastery of the knowledge, techniques, skills, and modern tools
- the ability to identify, analyze, and solve technical problems
- demonstration of effective communication
- develop a commitment to quality, timeliness, and continuous improvement

Syllabus

WEEK OF:	TOPICS	READINGS	TIMELINE
22-Aug	**Course Introduction.**	**TBA**	Introduction to the SSCC
	What is GIS? Getting Started		
	Logic and Foundations in Spatial Analysis;		**Exer1:** Intro to GIS: Creating Maps and using Libraries
	Spatial Data: challenges and opportunities.		
	Introduction to ArcGIS™, Maptitude™/TransCAD™, QGIS™ (Opensource), GoogleEarth™ GIS software.		
	Simulation GIS: The future?		
29-Aug	Introduction to ArcGIS™, Maptitude™/TransCAD™ GIS software (contd.).	**TBA**	**Exer2:** Adjacency
	Ask and Answer Geographic Questions part i:		
	Adjacency Tools		
	Map Layers/Sets		
	Thematic Maps		
5-Sep	**Ask and Answer Geographic Questions part ii:**	**Ch 1-6**	**Exer3:** Bands/Buffers
	Bands/Buffers		
	Map Layers/Sets contd. ii		
12-Sep	**Locating: Geocoding and web-based Mapping/Google Maps**	**ch 2**	**Exer4:** Geocoding
	Google Maps		
	Map Layers/Sets contd. iii		
19-Sep	Spatial field pattern Analysis;		
	frame free spatial analysis; Density Grids; TINS		
	Building Areas of Influence	**Ch 1-7**	**Exer5:** Surface Interpolation/TINS
	Map Layers/Sets contd. iv		
26-Sep	QGIS™ (open source free GIS)		**OPEN LAB/Makeup**

3-Oct	Exercises 1-5 due (one word document digital submission ONLY)		***Exer 1 - 5 due end of class period***
	GIS Analysis Tools: TIGER FILES	**TBA**	
	Map Layers/Sets contd. v		**Midterm Exam**
	Midterm Exam		***Midterm Due Friday Oct 15 but extend until Oct 18!***
10-Oct	**Joining data to a Map: Creating a relational join**		**Exer6a:** Data Join using relational algebra
17-Oct	**GIS Tools (extra): Editing Maps**	**TBA**	
	Project Description		**Exer6b:** Data Join using relational algebra contd.
	Introduction to Topological spatial analysis with GIS		
	GIS Analysis Tools (contd.):		
24-Oct	**Joining data to a Map: Creating a relational join contd.**	**TBA**	**Exer7: Network Analysis**
	Combining Attributes		
	Converting Lines and Areas		
	GPS		
	Map Projections		
31-Oct	**Network Analysis**	**TBA**	**Exer8: Network Analysis II**
	Shortest path routines		
	Network partitioning		
	Traveling salesman models		
7-Nov	**GIS Applications: Territory Management and Site Location Modeling**	**TBA**	**Exer9: Network Analysis III**
14-Nov	**TBA**	**TBA**	**TBA**
21-Nov	**Thanksgiving Break**		

28-Nov	**Visualizing Spatial Data: Visibility Analysis**	**TBA**	**Exer10:** Grid Analysis
5-Dec	REVIEW/ MAKEUP		
	Exercises 6-10 due (one Microsoft Word document -- digital submission ONLY)		Short Project presentations **(5 minutes each)**
12-Dec	**Monday: Scheduled Final Exam;** ***Final Exam Due; Project Due***		
21-Dec	**Grades Available on OneStart**		

Additional Readings

*LO and YEUNG Text Book.
This is provisional **SUPPLEMENTARY** reading for **students who require additional introductory GIS materials** but anyone interested can follow the reading guidelines below:

Assignments

Weekly Exercises

We encourage collaboration on the weekly exercises; you can learn a good deal from your fellow students. If you can't do all of a problem, see me …

Discussion Group

We invite scholars, teachers, students, and self-learners interested in "**Course G338/538: Geographic Information Science**" and encourage their interaction with others through the Discussion Group for this course.

SUGGESTED TOPICS FOR INDEPENDENT PROJECT

1. Find the Best Facility Locations
2. Use Aerial and Satellite Images for Geographic Editing
3. Perform Census Demographic Analysis

4. Compute Delivery Routes
5. Build Sales Districts
6. Compute Market Share

7. Verify Regulatory Compliance
8. Assess risk and underwrite insurance
9. Analyze Real Estate Trends

10. Find Crime Hot Spots
11. Visualize Three-Dimensional Surfaces

12. Determine Orders of Adjacency

13. Compute Accessibility to Public Transportation
14. Locate Your Customers and Facilities
15. Analyze Public Health Data

16. Produce Travel Maps
17. Link Map Features to Images, Web Sites, and Other Files

18. Import Geographic Data from Other GIS and CAD Software
19. Study Branch Locations
20. Analyze Sales Patterns to Target Advertising

21. Use QGIS or ArcGIS for any two assignments
22. Any other…