ADVANCED GEOGRAPHIC INFORMATION SYSTEMS
PDD/UST/PAD/ENV 643, FALL 2009

Sung-Gheel (Gil) Jang

Day & Time: Tuesdays, 6-9:50 p.m.
Location: UR 39
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Office Hours: Tuesday 4-5 p.m. and by appointment
Prerequisite: UST/ENV/PAD/PDD 642 or equivalent

Course Description
This course covers advanced concepts and principles of Geographic Information Systems/Science (GIS) with a particular emphasis on key concepts and analytical methods of geographic information, spatial databases, applications, and web services. While the lecture/discussion sessions cover underlying theory, lab sessions are organized to give students an opportunity to learn for themselves how to put those concepts and theory into practice through hands-on exercises with ESRI ArcGIS, open source GIS tools, and spatial databases. Upon completion of the course, successful students should be able to apply what they have learned immediately to their own research work and in their future professional careers.

Course Objectives
The specific objectives of the course are:
- Understand in-depth concepts underlying Geographic Information Systems/Science, including spatial concepts and representation, models of geographic information, essential spatial analysis methods, and uncertainty in geographic information;
- Explore the underpinnings of spatial databases, including data model, spatial query, and storage and indexing;
- Examine varied GIS application to let students have tangible ideas on how GIS will contribute to real practice and research;
- Discuss advanced techniques for sharing geographic information such as web-based GIS, metadata, interoperability, and spatial data infrastructure; and
- Integrate concepts of GIS theory and methodology with technical skills to design, implement and present a GIS project

Requirements
The course consists of lecture/discussion sessions and lab exercises. The students should attend both sessions and complete the following requirements: class discussions/participation; in-class lab assignments; homework assignments; a take-home exam; and a final term project with a paper.

1. Class discussions/participations
You are expected to 1) read all assigned readings prior to class; 2) submit discussion questions to the course Blackboard by 9 a.m. the day of class, and 3) come to class ready to participate.
2. In-class lab assignments
Every lab exercise includes an in-class assignment to practice what you have learned in the lab session. Students should submit the assignment by 9 a.m. the day of next following class.

3. Homework assignments
The homework assignments will help you figure out how to use the methods and techniques you have learned in class to solve research problems. You will be provided with a problem context, and a set of questions that are to be addressed.

4. Take-home exam
A take-home exam will be taken in lieu of midterm. The take-home will provide students with an opportunity to review the concepts and methods that they have learned during the first half of this course.

5. Final project
Students should conduct an individual project based on their interests and present their project with a final paper at the end of the semester. A specific instruction on its scope and content will be provided in the mid-point of the course.

Grading Policy

The course grade will be determined as follows:

- Class Discussions/Participations 10%
- In-Class Lab Assignments 10%
- Homework Assignments 25%
- Take-home Midterm Exam 20%
- Proposal Presentation 5%
- Final Presentation 5%
- Final Paper 25%

Grading scale:
A = above 93%, A- = 87-92.9%, B+ = 81-86.9%, B = 75-80.9%, B- = 70-74.9%,
C = 60-69.9%, and F = below 59.9%

TEXTBOOK/READINGS:

There is no required textbook for this course. All course readings, lecture notes, and lab materials will be available via the CSU Blackboard system (https://elearning.csuohio.edu/webct/entryPageIns.dowebct).

Recommended books:
CLASS POLICIES:

- Late submissions will result in a penalty on your grades except for any prudent and documented reasons. It will be 10% reduction of your grade per one day late, and you will not any grades after one week late. *Late submissions of discussion questions and in-class lab assignments are not accepted.*

- You should allot a reasonable amount of time for the workloads of this course outside of class every week. The CSU recommends that students should invest at least 3 hours out of class for each credit hour. That is, you will need at least 12 hours of work outside of class.

- Students should refer to the information from the Office of University Registrar (http://www.csuohio.edu/enrollmentservices/registrar) regarding administrative procedures related to drop, add, withdrawal, and incompletes.

- It is your responsibility to follow the University Policies such as Student Conduct Code and Academic Regulations and Procedures, which can be found at http://www.csuohio.edu/studentlife when you take this course.

- Educational access is the provision of classroom accommodations, auxiliary aids and services to ensure equal educational opportunities for all students regardless of their disability. Any student who feels he or she may need an accommodation based on the impact of a disability should contact the Office of Disability Services at (216) 687-2015. The Office is located in MC 147. Accommodations need to be requested in advance and will not be granted retroactively.

COURSE SCHEDULE

Note: ✓ required reading, ○ optional reading

**Week 1 (8/25) – Introduction**

Class topic:
- Course overview

Lab session:
- Lab logistics
- *ArcGIS refresher* (Learning ArcGIS Desktop: ESRI Virtual Campus Course, 8 modules)

**Week 2 (9/1) – Conceptual foundation I**

Class topic:
- Defining GIS
- Geographic problems & GIS

Readings:

Lab session:
- Geoprocessing in ArcGIS (Part I)

**Week 3 (9/8) – Conceptual foundation II**

Class topic:
- The nature of geographic data and knowledge
- Spatial concepts

Readings:

Lab session:
- Geoprocessing in ArcGIS (Part II)

>>> **Homework #1 assigned (by 9/22)**

**Week 4 (9/15) – Models of geographic information**

Class topic:
- Field-based model and object-based model
- Geographic representations

Readings:

Lab session:
- Creating, Editing, and Managing Geodatabases for ArcGIS Desktop [ESRI Virtual Campus Course]
Week 5 (9/22) – Databases and GIS

Class topic:
- Introduction to databases
- Relational databases

Readings:

Lab session:
- SQL primer

>>> Homework #1 due

Week 6 (9/29) – Spatial databases

Class topic:
- Object-oriented databases
- Spatial operations and relations

Readings:

Lab session:
- Spatial SQL

>>> Homework 2 assigned (by 10/13)

Week 7 (10/6) – Introduction to spatial analysis

Class topic:
- GIS and spatial analysis
- Exploratory spatial data analysis (ESDA)

Readings:

Lab session:
- ESDA in ArcGIS

**Week 8 (10/13) – Spatial statistical analysis using GIS**

Class topic:
- Spatial statistics
- Spatial statistical methods in GIS applications

Readings:
  - Ch. 6: Identifying ethnic neighborhoods with census data – Group concentration and spatial clustering (by Logan, J. R. and Zhang, W.)
  - Ch. 7: Spatial analysis of homicide with areal data (by Messner, S. F. and Anselin, L.)

Lab session:
- Spatial statistical analyses in ArcGIS

*** Homework #2 due ***

*** Take-home exam distributed (turn in by 6 p.m. October 20) ***

**Week 9 (10/20) – Service (market) area analysis**

Class topic:
- GIS & service area analysis

Readings:
Lab session:
  - Determine primary market area (PMA) using ArcGIS

>>> Homework #3 assigned* (by 11/3)

Week 10 (10/27) – Proposal presentations
Class topic:
  - Proposal presentations

Lab session:
  - TBA

Week 11 (11/3) – Decision analysis and GIS
Class topic:

Readings:

Lab session:
  - A multi-criteria decision analysis using ArcGIS

>>> Homework #3 due

Week 12 (11/10) – Participatory GIS
Class topic:
  - Public Participation GIS (PPGIS)
  - Privacy and legal issues

Readings:
Lab session:
- Web GIS (I): creating web mapping services using open APIs (e.g., Google Maps, Google Earth, Yahoo map, ESRI Web Mapping APIs)

**Week 13 (11/17) – Web GIS**

Class topic:
- Open Source GIS
- Underlying technologies

Readings:

Lab session:
- Web GIS (II): Building a customized web mapping services using Open Source applications (i.e., Geoserver + OpenLayer)

>>> **Homework #4 assigned (by 12/1)**

**Week 14 (11/24) – Sharing geographic information**

Class topic:
- Spatial data infrastructure
- Standards/interoperability

Readings:

Lab session:
- Creating and Maintaining Metadata Using ArcGIS Desktop [ESRI Virtual Campus Course]

**Week 15 (12/1) – Future trends and challenges**

Class topic:
- Emerging topics and future trends
- Challenges in GIS research
Readings:

Lab session:
- Final project week

>>> *Homework #4 due date*

**Week 16 (12/8) – Final project presentations**

*** Turn in your final term paper by 6 p.m. December 8 ***

*This schedule may be changed with a prior announcement.*