Geography 475 & 476: Advanced GIS and Lab
Spring 2011
Department of Geography
University of Idaho

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Office Hours (Dezzani): MWF 11:30 AM -12:30 PM or, by appointment.
I am NOT available on Tuesdays and Thursdays.
Prerequisites: Geography 385, Statistics 251, or instructor's approval.
Recommended Prerequisite: Geography 407/507 – Spatial Analysis
Lectures: MWF 1:30-2:20 pm in McClure 206.
LAB (476): F 12:30-1:20 PM in McClure 206 (we can change this time if necessary).

General Information:

The goal of this course is to learn to implement and interpret spatial analysis and spatial models in a GIS framework. Geographic Information Systems (GIS) are software that permit the explicit manipulation of spatial data. GIS are widely used in government and academia for planning, management, and research purposes. A working knowledge of GIS is essential in a modern geographic career, as it has become the primary tool of application and research. This course follows the NCGIA core curriculum recommendations for defining and implementing concepts in an advanced GIS course (see: http://www.ncgia.ucsb.edu/giscc/). As such, completion of this course is a key step in preparation for a position as a "GIS analyst."

The Geography 475 course is intended to provide the advanced GIS framework and an overview of the ArcGIS/ArcMAP/ArcInfo Workstation system as preparation for higher-level analysis and programming. The course will emphasize a high degree of competence in the use of ArcGIS for analytical purposes. Thus, primary orientation of the course is to provide a sound theoretical and applied basis so that the student will obtain knowledge of GIS required for research and analysis. Consequently, a wide variety of methods and algorithms will be covered to inform the student of many different types of database design and spatial analysis and the interpretation of results. In addition to exams, the primary course requirement is the development and execution of a project that will require the acquisition of data, design of a spatial database, formulation of research questions and hypotheses, and execution of appropriate analysis using GIS and spatial analysis.

As this course is focused on analysis (i.e., spatial analysis), a Statistics prerequisite is required of students. A significant portion of the course will focus on the development and implementation of a variety of statistical and analytical ideas/methods. As most GIS is extremely limited as to spatial analytical capability, we will be using Geoda and other software that is compatible with ArcGIS and the shapefile/coverage geodatabase format for analysis.

The applied side of the course requires the development of additional skills in the use of ArcMAP, and ArcGIS/ArcInfo. The emphasis is not on mere representation, but on the analysis of spatial data and spatial database design for complex problem solving. Spatial data with topology will also be an object of analysis.

Each student must have a University of Idaho computer account before beginning the homework assignments/exercises.

Texts and Readings: *Two course textbooks are required*.

1.) O'Sullivan, David and David J. Unwin. 2010. *Geographic Information Analysis. Second Edition*. John Wiley & Sons, Inc. New York.
2.) Fotheringham, S., C. Brunsdon and M. Charlton. 2000, 2004. *Quantitative Geography: Perspectives on Data Analysis*. Sage. (Hereafter FBC 2004).

Three other volumes **are not required** but are optional for your purchase and are recommended to enhance the understanding of GIS:

1.) Burrough, Peter A., and Rachael A. McDonnell. 1998(2000). *Principles of Geographical Information Systems*. Oxford University Press. Oxford, UK.
2.) *Chang, Kang-tsung. 2006. Introduction to Geographic Information Systems.* Fifth Edition. McGraw Hill. (Hereafter Chang 2008).
3.) ESRI. 1997, 2001. *Understanding GIS: The Arc/Info Method for Version 7.1 (or 8.2) for UNIX and Windows NT/2000/2002/XP*. John Wiley & Sons, Inc. New York.

Readings will be taken from these texts and provided to you as handouts and additional readings and papers will be provided in the lectures or online at the UI **BlackBoard** site as handouts and lecture notes.

Software: Geographic Information Systems (GIS) requires hardware, software and expertise for effective implementation. The ArcGIS/ArcMap 9.3 and ARC/Info Workstation system version 9 will be used as the primary GIS software. The ArcGIS/ArcInfo system is very sophisticated software and requires a great deal of time to master. During the semester only a small but crucial portion of the entire software can be covered. Lab exercises will not begin until the 3rd week of classes. At least six (6) exercises will be completed in the 476 course component, in addition to the substantial research project required for the 475 portion. Additional software for analysis will be introduced during the assignment descriptions. Software such as CrimeStat III, SAM (Spatial Analysis for Macroecology) and Geoda will be used for analysis of spatial data in addition to a variety of ArcTools and the analytical tool boxes in ArcMap and ArcGIS such as the spatial statistical toolbox. The additional software is available on the HP workstations in room 206 McClure.

Lecture (475)Assignments, Examinations, Project and Grading: The course grade will be distributed by completion of course requirements as follows:

Project proposal	10%	{due before midterm exam}
Exam 1 (midterm)	25%	
Exam 2 (final)	25%	
Research Project	35%	{due at the end of the semester}
Attendance and lecture participation	5%	

Lab (476) Grading:

6-7 assignments (exercises)	90%	(approx. 13 - 15% each)
Attendance and Participation	10%	

Attendance at lectures and lab is mandatory! All rules and expectations of student behavior as outlined in the University of Idaho Student Conduct Code in the catalogue apply. The 2 examinations will test knowledge of course/lecture content; each exam will be 1 hour - the duration of a lecture. The dates of the exams are approximate and will be confirmed prior to exams. Lab assignments will begin during the 3rd week of classes and due dates will be assigned at the time of issue. These

assignments will provide experience and reinforce the lecture materials. The semester project will consist of an analysis and written research paper, usually consisting of 10-15 pages, on a topic provided by the Professor. Graduate students will conduct their own research projects independently, usually as part of their master's or Ph.D. researches, with topic approved by the Professor and submit a 20-25 page unique research paper. Late assignments will be penalized by a reduction in the grade of up to 50%. ***Cheating on exams and plagiarism in research papers will result in an automatic "F" for the course component.*** NO SUBSTITUTIONS FOR COURSE REQUIREMENTS ARE CONSIDERED.

Course Calender

SCHEDULE of LECTURE TOPICS (time distribution is approximately 2 weeks per topic):

1) Introduction, course objectives and overview of Geographic Information Systems and the ArcGIS/ArcInfo System. Spatial data and the spatial perspective and spatial thinking. Reading: *Chapter 1 and 2 in O'Sullivan and Unwin (2010); chapter 1 in Fotheringham et. al. (2004) and handouts*.

2) Fundamentals – Map models, vector and raster Data structures, spatial data, data acquisition/design and entry, TOPOLOGY and geodatabase design. Reading: *Chapters 3 and 4 in O'Sullivan and Unwin (2010); chapters 2-4 in Fotheringham et. al. (2004) and handouts.*

3) Point Pattern and introductory area-based analysis Reading: Chapter 5-7 in *O'Sullivan and Unwin (2010); chapter 6 in Fotheringham et. al. (2004) and other materials.*

4) Georeferencing and coordinate systems; map projections. Reading: papers and book(s) on class BlackBoard site *along with additional papers and handouts*.

Midterm

5) SPATIAL ANALYSIS/Modeling using GIS:

a) Local Analysis and continuous surfaces/Interpolation. Reading: Chapter 8 in *O'Sullivan and Unwin (2010); chapter 5 in Fotheringham et. al. (2004) as well as additional readings and handouts.*

b) Spatial Analysis of Discrete Entities (Vector and Raster) modeling and overlay construction: GIS operations and spatial statistics. Spatial regression, SAR and GWR models. Reading: Chapters 9-11 in *O'Sullivan and Unwin (2010); chapters 7-8 in Fotheringham et. al. (2004) as well as additional reading and handouts.*

6) New Approaches and Future Directions in Spatial Analysis and GUIS. Reading: Chapter 11 in *O'Sullivan and Unwin (2010); chapters 9-10 in Fotheringham et. al. (2004) and handouts.*

Final Exam: Tuesday, May 10, 2011.

***EXAM I (midterm)** will take place after the completion of topic 4 on coordinate systems.
***EXAM II (final)** takes place during the scheduled final exam period, Tuesday 10, May 2011 from 12:30 PM to 2:30 PM in room 206 McClure. The final exam *will not* be strictly cumulative, as it will emphasize the material in topics 5 and 6.

*The project research paper is due <u>NO LATER</u> than: *Friday*, May *6*, 2011 by 4:00 pm.

<u>Note:</u> Failure to submit exercises or course requirements on time will result in a 5% penalty tabulated for each lecture the materials are not turned in. This penalty can attain a maximum of 50% - which, results in automatic failure for that exercise. If the assignment is never received, then a score of zero or, complete loss of points is assigned for that exercise/requirement.