

## **GEOG 4710/7710 Spatial Analysis**

**Fall, 2009**

Lecture: Tuesday & Thursday 9:30-10:45AM, Room 106  
Lab (when there is): Thursday, 9:30-10:45AM, Room 107.

**Instructor:** Dr. Cuizhen (Susan) Wang

Office: 10A Stewart Hall  
Office hrs: Tuesday and Thursday 2:00-3:30PM; other times by appointment  
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### **Textbook**

Wong D. W.S. and Lee, J., Statistical analysis of geographic information, with ArcView GIS and ArcGIS, 2005. John Willey and Sons, Inc.

### **Course Description:**

Spatial is special, and special forms of analysis are required for handling spatial data. Spatial statistics is a cover-all term for a diverse family of methods that describe and model characteristics of spatial data. In some cases spatial location is the only factor being analyzed (e.g. disease point pattern). In other cases the primary interests concerns an attribute present everywhere but sampled only at a subset of locations (e.g. DEM data). A third set of cases involves the analysis of data collected and stored in spatial zones (e.g. U.S. Census data). While these three cases are by no means exhaustive, they do represent the wide range of applications that we will deal with in this course.

Our objective is to learn and employ basic statistical techniques for describing, modeling, and analyzing these three basic types of data. The first quarter of classes will focus on descriptive statistics and exploratory data analysis. Remaining classes will focus on point pattern analysis, spatial regression, and continuous data analysis.

### **Grading Scheme:**

**(We will have 4 exams. Only the highest 3 exams are used in grade calculation.)**

	<b>Lecture</b>	<b>Lab</b>	<b>Project</b>		
Lab Exercises	----	25%			
Quiz (class exercise)	5%	----			
1 <sup>st</sup> lecture exam (statistics):	10%	---			
2 <sup>nd</sup> lecture exam:	20%	----			
3rd lecture exam:	20%	----			
Project Proposal:	---	---	0%		
Class Project:	---	---	15%		
<b>Total score</b>	<b>55%</b>	<b>+</b>	<b>30%</b>	<b>+</b>	<b>15% = 100%</b>

For example, if your average quiz = 90 points, average lab grade = 80 points, Exam1 = 95 points, Exam2 = 60 points, Exam3 = 93 points, and project = 90, then your final score =  $(90*0.05+80*0.3+95*0.1+60*0.2+93*0.2+90*0.15) = 82.1$ .

**The final grade is upon the histogram of total scores of all students. Different rule will be applied to 4710 and 7710.**

### **Software in the lab:**

We will practice Excel and ArcGIS software in the SPAM lab. Although basic knowledge of these softwares is preferred, it is **not required** at the beginning of this class. The primary objective of the labs is to practice a diverse and powerful set of analytical techniques for gaining insight into geographical processes and patterns.

### **Final Project**

The project involves original work using some spatial data and several of the techniques discussed in class. Sooner or later after you step into this class, you may have a specific problem in mind, and some data you want to analyze. For example, if your current research interest is studying yield variation across a corn field, and you intend to use this class to help you develop techniques to tackle this problem, then it would make sense to use some existing yield data for your project.

Limiting the size of the problem is a good idea. If you collect your data and solve the input problems, no matter how perfect they are, rather late in the semester, you may end up with limited time to perform the analysis and the writeup.

Group projects (up to 2 persons in same level (4000 or 7000)) are acceptable. Group project has higher grading criteria.

The project includes three parts: proposal, and final writeup.

**Project proposal** (no grade. Due on Nov. 19)

One-page typed document describing the data that you intend to use in the final project:

- data type, quantity, areal distribution, attributes if any, etc.
- data source
- potential research question(s)

The purpose of this proposal is to guide you with your research idea and practical steps. I will review the pre-proposal and discuss with you if there needs any modification.

**Project writeup** (15% overall grade. Due on Dec. 11)

The paper should be around 10 pages (double-spaced) in length. It is a research report.

Write in a professional journal-paper style. Describe clearly:

- title
- Introduction
- research problem
- data description
- methodology
- results

- conclusion/discussion, and
- references if any.

It is particularly important that you describe the statistical and spatial analysis techniques you employ and explain why you are using them. Figures and tables should be included if they are helpful. No plagiarism! Cite it whenever you use other's ideas or work.

### **Late Policy:**

**Lab Assignments and final projects handed in late will receive a 5% penalty for each day late up to five weekdays. Assignments turned in more than 5 weekdays late will not be accepted for grading.**

### **Academic dishonesty:**

*Academic integrity is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards breaches of the academic integrity rules as extremely serious matters. Sanctions for such a breach may include academic sanctions from the instructor, including failing the course for any violation, to disciplinary sanctions ranging from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, collaboration, or any other form of cheating, consult the course instructor.*

### **Support Services for Students with Disabilities (ADA):**

*If you need accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class, or at my office.*

Office location: \_\_\_\_\_ Office hours: \_\_\_\_\_

*To request academic accommodations (for example, a notetaker or extended time on exams), students must also register with the [Office of Disability Services](http://disabilityservices.missouri.edu), (http://disabilityservices.missouri.edu), S5 Memorial Union, 882-4696. It is the campus office responsible for reviewing documentation provided by students requesting academic accommodations, and for accommodations planning in cooperation with students and instructors, as needed and consistent with course requirements. For other MU resources for students with disabilities, click on "Disability Resources" on the MU homepage.*

### **Sample Statement for Intellectual Pluralism**

*The University community welcomes intellectual diversity and respects student rights. Students who have questions concerning the quality of instruction in this class may address concerns to either the Departmental Chair or Divisional leader or Director or the Director of the [Office of Students Rights and Responsibilities](http://osrr.missouri.edu) (http://osrr.missouri.edu/). All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.*

Week	Date	Lecture/lab topic
1	Aug. 25	Introduction to spatial analysis
	Aug. 27	Overview: descriptive statistics (1)
<b>Stochastic statistics</b>		
2	Sept. 1	Overview: descriptive statistics (2)
	Sept. 3	Overview: correlation and regression (1)
3	Sept. 8	Overview: Correlation and regression (2)
	Sept. 10	<b>Lab1: Intro to descriptive stats and regression</b>
4	Sept. 15	Overview: probability and Z-table
	Sept. 17	Overview: hypothesis test (1)
5	Sept. 22	Overview: hypothesis test (2)
	<b>Sept. 24</b>	<b>Exam 1 (Open book)</b> <i>Self-learning: Introduction to ArcGIS</i>
<b>Point pattern</b>		
6	Sept. 29	Spatial Analysis: introduction
	Oct. 1	Point pattern visualization
7	Oct. 6	1 <sup>st</sup> -order point pattern exploration (1)
	Oct. 8	<b>Lab2: Centrographic measure in ArcGIS</b>
8	Oct. 13	1 <sup>st</sup> -order point pattern exploration (2)
	Oct. 15	2 <sup>nd</sup> -order point pattern exploration (1)
9	Oct. 20	2 <sup>nd</sup> -order point pattern exploration (2)
	Oct. 22	<b>Lab3: 1<sup>st</sup> and 2<sup>nd</sup>-order point pattern exploration</b>
10	Oct. 27	point pattern interaction
	Oct. 29	<b>Lab3 (conti.)</b>
<b>Area pattern</b>		
11	<b>Nov. 3</b>	<b>Exam 2</b>
	Nov. 5	Polygon pattern exploration
12	Nov. 10	Polygon pattern visualization
	Nov. 12	Polygon data autocorrelation (1)

13	Nov. 17	Polygon data autocorrelation (2)
	Nov. 19	<b>Lab4: spatial autocorrelation</b>
14	Nov. 14	Thanksgiving week
	Nov. 26	
15	Dec. 1	Introduction to continuous data
	Dec. 3	Trend surface analysis / krigging
16	<b>Dec. 8</b>	<b>Exam 3 ???</b>
	<b>Dec. 11</b>	<b>Working on class project</b>
		<b>Dec.12 – class project due</b>
17	Free	