

**Course Information for
22S:167 (STAT:6530) “Environmental and Spatial Statistics”
Spring 2015**

Instructor

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Course Format

Lectures 9:30 – 10:20 MWF in 150 SH. Occasionally we may meet instead in the Statistics Graduate Computing Lab, 346 SH.

Office Hours

1:30 – 3:30 pm Mondays, 1:30-3:00 pm Thursdays (this may need to be moved), or by appointment

Department Information

Department of Statistics and Actuarial Science, 241 Schaeffer Hall, Phone 335-2082

Department Executive Officer

Professor Joseph Lang, 241 SH, Phone 335-0712, E-mail joseph-lang@uiowa.edu

Textbook

There are no required textbooks for the course. Lecture notes, freely provided for download from Professor Zimmerman’s webpage, will serve as a quasi-textbook, and these will be supplemented by assigned readings (excerpts of books) made available to the students in the course. For further background reading, recommended books are *Hierarchical Modeling and Analysis for Spatial Data*, by Banerjee, Carlin, and Gelfand (Chapman & Hall/CRC Press), and *Statistical Analysis of Spatial and Spatio-Temporal Point Patterns*, 2nd edition, by Diggle (Chapman & Hall/CRC Press).

Course Prerequisites

22S:152 (or equivalent) and 22S:154 (or equivalent).

Course Objectives

To learn some of the most important methods for explicitly accounting for time and space (mostly the latter) in the statistical analysis of environmental data. In addition to learning the methods, it is our goal to learn when and why they are appropriate, what the underlying assumptions are, and how to implement the methods using various statistical software packages. With rare exceptions, we will not be concerned with deriving the methods using statistical theory, but we will occasionally use statistical theory to obtain statistical properties of the methods.

Students taking this course are mainly of two types: (1) Statistics M.S. students, who have had courses more advanced than the prerequisites for this course; (2) Graduate students from

Geography, Civil Engineering, and other fields who barely have (or in some cases simply don't have) the necessary course prerequisites. Currently, we need students of both types in order to have healthy enrollment for the course. The course objectives differ slightly for the two groups: the first group needs a theoretical understanding of the statistical methodology, while the second does not. Accordingly, the course content includes some theory, but homework and exam problems requiring more advanced theory will be assigned to only the first group; those problems will be replaced with more applied problems for the second group.

Major Topics Covered

- Exploratory temporal and spatial data analysis
- Temporal trend detection and estimation
- Geostatistics: Semivariogram estimation and Kriging
- Spatial regression
- Environmental monitoring network design
- Lattice (areal) data analysis, including disease mapping
- Spatial point pattern analysis
- Modeling spatio-temporal data
- Methods for sampling environmental populations (time permitting)

Computing

Substantial computing will be necessary to complete many homework assignments and the final project. Our software of choice will be R, but we will also use SAS occasionally. Instructions on their use will be provided in class.

Homework

Written homework assignments are an essential component of the course. Assignments will be given approximately every week to 10 days. Assignments must be turned in at the beginning of class on the day they are due. Unless prior arrangements are made, homework turned in late will receive a score no higher than 50%. You may work on homework problems together, but outright plagiarism is prohibited. Each student must write up their own work.

Some assignments will involve the analysis of data using a computer. Any computer output you wish to include with your homework should be fully labeled and annotated, and should be integrated with other parts of the homework by electronically cutting and pasting.

Some homework assignments may include some problems assigned only to Statistics graduate students, and other problems assigned only to non-Statistics graduate students. Every effort is made to "equalize" these assignments.

Attendance

Attendance at lectures and participation in discussions are expected. Coming late to class, leaving early, or failing to attend class often will lower your grade.

Midterm Exams

Two in-class midterm exams will be given; the first in early March, and the second in mid-April. These exams will be “closed-book” but “open-notes,” meaning that during the exam you can look at your lecture notes, past homework assignments, and anything else that you have written, but you may not look at other printed or electronic materials. As with homeworks, some exam problems may be assigned only to Statistics graduate students and others only to non-Statistics graduate students.

Final Project

In lieu of a final exam, each student will write a “term paper” on a spatial statistics topic of his or her own choosing (but one which has not been covered in class). This paper can be based on papers in the spatial statistics literature or on original research, and they should include a worked example with computer code (if appropriate). Professor Zimmerman can provide ideas for possible topics. A written term paper proposal (of length one page or less) must be turned in within one week after the second midterm exam. More guidance regarding the term paper will be provided after spring break.

Grading

- Homework and Attendance, 40%
- Midterm Exams, 40% (20% each)
- Term Paper, 20%

Plus-minus grading will be used.

Academic Fraud

All forms of plagiarism and any other activities that result in a student presenting work that is not his or her own are academic fraud. All academic fraud is reported first to the departmental DEO and then to the Associate Dean for Academic Programs and Services. See Academic Fraud at http://www.clas.uiowa.edu/students/academic_handbook/ix.shtml for the complete policy.

Making a Suggestion or Complaint

Students have the right to make suggestions or complaints and should first visit with me, then with the departmental DEO (if necessary). All complaints must be made as soon as possible. For more information, visit Student Complaints at

http://www.clas.uiowa.edu/students/academic_handbook/ix.shtml

Students with Disabilities:

I would like to hear from anyone who has a disability that may require some modification of seating, testing, or other class requirements so that appropriate arrangements can be made. Please see me about this as soon as possible.

Understanding Sexual Harassment

Sexual harassment is reprehensible and will not be tolerated by the University. It subverts the mission of the University and threatens the well-being of students, faculty, and staff. Visit

this site (<http://www.sexualharassment.uiowa.edu/>) for definitions, assistance, and the full University policy.

Reacting Safely to Severe Weather

The University of Iowa Operations Manual section 16.14 outlines appropriate responses to a tornado (see subsection (i)) or to a similar crisis. If a tornado or other severe weather is indicated by the National Weather Service radar, the Johnson County outdoor weather sirens will sound. If these sirens sound (and it is not the first Monday of the month at 9:00 am when the sirens are tested), members of the class will seek appropriate shelter immediately, continuing class if possible when the event is over.

Student Classroom Behavior

The ability to learn is lessened when students engage in inappropriate classroom behavior, distracting others; such behaviors are a violation of the Code of Student Life. When disruptive activity occurs, a University instructor has the authority to determine classroom seating patterns and to request that a student exit the classroom, laboratory, or other area used for instruction immediately for the remainder of the period. One-day suspensions are reported to appropriate departmental, collegiated, and Student Services personnel (Office of the Vice President for Student Services and Dean of Students).