GEOG 6000
Advanced Geographical Data Analysis

Professor:	Simon Brewer
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	Gardner Commons, 4845
Office Hours:	Mon-Wed 1:15-2:45pm

Class time and location:	Mon-Weds: 3:00 pm - 4:20 pm; GC 4150 Weds: 4:35 pm - 5:50 pm; GC 1825 (lab)
Prerequisite:	GEOG 3020 Geographical Analysis (or equivalent)

Grading:	Exercises	60pts
	Presentation	5pts
	Project Proposal	5pts
	Final Project	50pts
	Total	**120pts**

Course description: Geographical research increasingly generates large and complex datasets. The course is designed to introduce students to:

- A suite of techniques for the analysis of such datasets
- The interpretation of results generated
- The appropriate (and inappropriate) use of these methods.

Topics will include advanced regression analysis, the analysis of multivariate datasets, spatial analysis and time series analysis. Theory will be taught during lectures, but emphasis will be placed on the practical application of these techniques and best-use practices in the analysis of research datasets. The majority of topics will be accompanied by in-class lab exercises using the statistical software R, as well as take-home exercises. Students will be required to give a short presentation of a figure displaying results of an analysis, and over the course of the semester, will undertake a short research project using one or more of the techniques covered in the course.

The class meets three times a week, with lectures on Monday and Wednesday (3:00-4:20 pm), and computer lab time on Wednesday (4:35-5:50 pm). Lab time will be used for practical exercises based on the lecture material presented that week.

Course goals: Students completing the course will have

- A toolbox of statistical techniques for use with geographical data
- Experience in planning the analysis based on the type of datasets commonly generated in geographical research
- The ability to interpret the results of such analyses with their own data and in other studies
- Experience in presenting the results of analysis

- Experience with one of the most commonly used and generally applicable software packages for statistical analysis

Class policies:

- Individual extra credit will not be assigned
- **Any assignment, including the project report, turned in after the due date will only be worth half the earned points**
- Materials (exercises, project report) must be turned in electronically
- Collaboration between students is encouraged, but **final products must show evidence of individual effort**. If not, no credit will be given.
- The course will cover a broad range of material and many classes will depend on information from the previous class: full attendance is encouraged

GEOG 6000 Preliminary Class Schedule[1]

Date	Topic	Class	Lab
19-Aug	**Introduction**	*Intro to class*	
21-Aug		Probability	Intro to R
26-Aug		Inference	
28-Aug	**Modeling**	Linear models	Inference lab*[2]
2-Sep	**Labor Day**		
4-Sep		Multivariate models	Modeling lab 1
9-Sep		Effects and model selection	
11-Sep		Generalized models I	Modeling lab 2*
16-Sep		Generalized models II	
18-Sep		Mixed effects models I	Modeling lab 3*
23-Sep		Mixed effects models II	
25-Sep	**Multivariate data**	Cluster analysis	Modeling lab 4*
30-Sep		Ordination	
2-Oct		*Project discussion*	MVA lab*
7-Oct	**Fall break**		
9-Oct			
14-Oct	**Time series analysis**	Time series analysis I	
16-Oct		Time series analysis II	Time series lab*
21-Oct	**Spatial analysis**	*Intro to spatial data*	
23-Oct		Point processes I	Spatial data in R
28-Oct		Point processes II	

[1] Every effort will be made to keep to the scheduled class order, however, some adjustments may be made as the semester progresses

[2] Indicates lab with accompanying exercise

30-Oct		Point processes III	Point process lab*
4-Nov		Geostatistics I	
6-Nov		Geostatistics II	Geostats lab 1*
11-Nov		Geostatistics III	
13-Nov		Spatial regression I	Geostats lab 2*
18-Nov		Spatial regression II	
20-Nov		Spatial regression III	Spatial regression lab 1*
25-Nov		*Introduction to Bayesian analysis*	
27-Nov		Bayesian modeling	Spatial regression lab 2*
2-Dec		Space-time regression	
4-Dec		Class review	Bayesian lab

Course materials

As this course covers a wide range of subjects, there is no single required text. PDFs will be made available from the following books:

1. Kuhnert, P. and W. Venables, 2005, *An Introduction to R: Software for Statistical Modelling & Computing*. CSIRO Australia (PDF)[3]
2. Owen, W.J., 2007, *The R Guide*. Dept. of Mathematics and Computer Science, University of Richmond. (PDF)
3. Maindonald, J.H., 2004, *Using R for Data Analysis and Graphics, an Introduction* (PDF)
4. Okansen, J. *Multivariate Analysis of Ecological Communities in R: vegan tutorial* (PDF)
5. Bivand, R.S., E.J. Pebesma, and V. Gomez-Rubio (2008). *Applied Spatial Data Analysis with R*. Springer, 374 pp. (PDF)
6. Metcalfe, A.V., and P.S.P. Cowpertwait, 2009, Introductory Time Series with R. Springer Press, New York, 246 pp. (PDF)

Additional readings may be assigned as appropriate for the discussion topic

Grading

Students' point totals will be converted to percentages and then used to assign letter grades following the scheme provided below, using .5 as the break point:

A	95+	C+	70~74
A-	90~94	C	65~69
B+	85~89	C-	60~64
B	80~84	D	50~59
B-	75~79	E	~49

Assessment

[3] Readings marked (PDF) will be made available through Canvas

1. Exercises
There will be 10 graded exercises throughout the course, each worth 6pts. These will generally consist of 1-2 questions that will follow-up on the preceding computer lab, and require analysis of a new dataset and some brief interpretation of the results. Exercises are due one week after they are made available. Questions and data files will be made available through Canvas.

2. Figure presentation
All students will be required to give a short presentation based on a single figure showing the results of an analysis (5pts). The presentation should demonstrate the student's skill in describing the figure as well as communicating purpose, results and interpretation. Figures may be taken from published literature or from the students own research work. Presentations will be assessed by peer-review, with a set number of students assigned to review each presentation. Presentation and review assignments will be defined during the first two weeks of the semester. **Students who fail to provide assigned reviews will have points docked from their own presentation.**

3. Final project
Guidelines for final project:
Students are required to undertake a short research project based on one or more of the techniques covered in the class, and are encouraged to use their own data for this analysis. Students who have not yet generated datasets are should contact the course instructor to discuss suitable alternatives. Students may use the same data that they have used/will use in their other projects. **However, the final products to be presented or submitted for this course must be independent of any other projects or classes.**

The project will be evaluated on two parts:

- A one-page proposal (5pts, due September 20th). This must be approved by the instructor before continuing
- A project report (50pts, due December 13th)

The **one-page proposal** should describe the following:

- Topic of your final project,
- Why you are interested in the topic and/or why it is important for your research field, community, society, …
- Tentative list of datasets to be used (include both datasets you already have and those you need to find)

The **project report** should take the form of a short (ca. 8-10 pages) scientific research article with a title page and elements listed below. The final paper must be typed (double space, 10-12 fonts); no hand-written submission will be accepted. Figures are encouraged!

- Abstract (10-15 lines)

- Introduction, explaining objectives of your project and the background of the topic
- Literature review, which may be combined with Introduction. A minimum of 5 references (journal articles, book chapters, etc.) is required. The references should cover both methodological aspects and applications of the project.
- Methods including
    - Description of data, study region, etc.,
    - Summary of statistical methods used (and their implementation),
- Results
- Discussions
- Conclusions
- Bibliography, listing all the references cited in the paper.

Class policies:

- Evaluation-related policies
    - Individual extra credit will not be assigned.
    - There will be no "make-up" exams, quizzes, or assignments.
    - An "incomplete" grade will be given only in extreme cases when conditions beyond the student's control require an extended period of absence.
    - Any assignments, including the final project report, submitted to the instructor after its due date will be worth only half of the earned points.
    - Materials to be turned into the instructor must be typed.
    - Students are encouraged to help each other in their work. However, final products turned into the instructor must display evidence of individual initiative and creativity. If not, no credits will be given to the particular work.
- Attendance
    - Full attendance is strongly recommended. The content of the course is often progressive, meaning you must know the material from previous class meetings in order to understand subsequent material. When missing classes, students are responsible for seeking for help to catch up with the class progress in a timely manner, if they need to.
- Email correspondence
    - Students must copy themselves on any email to the instructor to ensure documentation of submission date and time. Doing so will assist the student when system outages occur.
    - Senders must also validate that all files are in readable format. Corrupted files are the responsibility of the sender and corrupted-file assignments will be marked as late
- Cell phones
    - Please turn off your cell phones or use vibrate/silence mode during class meetings.
- Student responsibilities

    - All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook of the University of Utah (http://www.acs.utah.edu/sched/handbook/toc.htm). Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.
- Liability warning
    - Students are responsible for all activities on their computer accounts. Keep your user name and password confidential.

ACADEMIC MISCONDUCT SYLLABUS STATEMENT

- Academic misconduct will not be tolerated. Penalties may include failure of an assignment, the entire course, and/or the filing of formal charges with appropriate university authorities. Academic misconduct includes, but is not limited to, cheating, misrepresenting one's work, and plagiarism:
- Cheating involves the unauthorized possession or use of information in an academic exercise, including unauthorized communication with another person during an exercise such as an examination.
- Misrepresenting one's work includes, but is not limited to, representing material prepared by another as one's own work or submitting the same work in more than one course without prior permission of all instructors.
- Plagiarism means the intentional unacknowledged use or incorporation of any other person's work in one's own work offered for academic consideration or public presentation.

As the only institution in the state classified in the highest research category (R1), at the University of Utah you will have access to state-of-the-art research facilities and be able to be part of the knowledge creation process. You will have the opportunity to do research of your own with faculty who are leading experts in their field, engaging in programs that match your research interests. Further, you will interact with and often take classes with graduate students that provide an advanced understanding of the knowledge in your field.

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the instructor and to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD) to make arrangements for accommodations. All written information in this course can be

made available in alternative format with prior notification to the Center for Disability Services.

Undocumented Student Support. *Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center.* ***Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence.*** *The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families.* ***To learn more, please contact the Dream Center at 801.213.3697 or visit dream.utah.edu.***

Safety & Wellness*. Your safety is our top priority. In an emergency, dial 911 or seek a nearby emergency phone (throughout campus). Report any crimes or suspicious people to* ***801-585-COPS (801-585-2677)****; this number will get you to a dispatch officer at the University of Utah Department of Public Safety (DPS; dps.utah.edu). If at any time, you would like to be escorted by a security officer to or from areas on campus, DPS will help — just give a call.*

The University of Utah seeks to provide a safe and healthy experience for students, employees, and others who make use of campus facilities. In support of this goal, the University has established confidential resources and support services to assist students who may have been affected by harassment, abusive relationships, or sexual misconduct. A detailed listing of University Resources for campus safety can be found at https://registrar.utah.edu/handbook/campussafety.php

Your well-being is key to your personal safety. If you are in crisis, call ***801-587-3000****; help is close. The university has additional excellent resources to promote emotional and physical wellness, including the Counseling Center (https://counselingcenter.utah.edu), the Wellness Center (https://wellness.utah.edu), and the Women's Resource Center (https://womenscenter.utah.edu). Counselors and advocates in these centers can help guide you to other resources to address a range of issues, including substance abuse and addiction.*

To report suspicious activity or to request a courtesy escort, call campus police at ***801-585-COPS (801-585-2677)****. You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.*

Evacuation map