Spring 2023 UMass Department of Geosciences

GEO 468/668: GIS and Spatial Analysis 3 cr

Schedule TuTh 11:30-12:45 In person Classroom Lectures in 225 Morrill III and Labs in 212 Morrill III
Instructor <PROF_FULL_NAME>, Ph.D, <PROF_EMAIL>, *Office hour* Mon 10-11 Th 12:45-2:00 or by appointment
TA <TA_FULL_NAME>, <TA_EMAIL>, *Office hour* Tue Wed 10-11 or by appointment

OBJECTIVES

This is an upper-level GIS course for students to obtain intermediate to advanced GIS skills to solve science and application problems. Extended from Introductory GIS, the course focuses on vector- and raster- based GIS techniques and spatial analysis. In addition, we will introduce the spatial statistics and geostatistical principles and tools. We will have the opportunities to work with model builder, which is a useful tool for creating your own models. Upon the completion of this course, students are expected to be able to:

- Conduct geospatial analysis (vector and raster)
- Design and create models with model builder
- Understand and use common spatial statistics tools
- Interpret and evaluate the outcomes of GIS analysis in wider research contexts
- Improve writing and presenting skills for describing technical specifications

PREREQUISITE

- Introductory GIS (NRC585 or GEOG593G),
- Familiar with computer, MS Word.
- High school math and geometry, including Trigonometry.

REQUIRED TEXTBOOKS

1. GIS Fundamentals: A First Text on Geographic Information Systems, 7th edition, Paul Bolstad, Eider Press, White Bear Lake, MN. https://www.gisfundamentals.org/ ($44 Print, $24/$18 digital lifetime/rental)
2. The lab book includes the selected chapters from Mastering ArcGIS Pro (2nd edition). Order either print copy or digital copy from McGraw Hill Create following the URL posted in Moodle. We will need the book in the 2nd week, so please order ASAP.

REFERENCE TEXTBOOK

The list includes the reference books I used to prepare the course. You are not required to read them.

3. Mastering ArcGIS Pro, 2nd edition, Maribeth Price, McGraw Hill Higher Education.
4. Concepts and Techniques of Geographic Information Systems, 2/E, Chor Pang Lo, Albert K.W. Yeung (2007)
5. Introduction to Geographic Information Systems, K. Chang, McGraw Hill
6. Interactive Spatial Data Analysis, T.C. Bailey and A.C. Gatrell, Prentice Hall, 1995.
7. David O'Sullivan, David J. Unwin, Geographic Information Analysis, Wiley, Inc, Hoboken, New Jersey, ISBN: 978-0-470-28857-3, 2nd ed, Hardcover, 432 pages, March 2010.

COURSE STRUCTURE AND EXPECTATIONS

- **Course Structure** The courses are composed of topics. Each topic will be introduced by lecture, in-class exercise, and lab assignments. Students will be asked to bring their own laptop or tablet to class to work on pop quizzes.
- **Lab** We will use ArcGIS Pro for labs. Attendance to class either in person or online is mandatory when health conditions are allowed. Besides class time, students are also expected to use extra time to complete weekly assignments and submit on time.
- **Final Project** All students are required to complete a final project in small groups. You are encouraged to define the objective of your project, collect all necessary data and perform spatial analysis. A final report is due on the last day of final exam.
- **Estimate of student workload and time commitment** The weekly lectures and in-class exercise will require 2.5 hours. The weekly readings will require at least 1.5 hours. The weekly effort on the homework/lab assignments is at least 2 hours. The weekly workload for the final project will vary throughout the semester from 0 hours at the beginning of the semester to 4 hours per week near the end.

HOW TO RUN ARCGIS PRO USING YOUR OWN COMPUTER

- A MS Windows computer is required to install ArcGIS Pro with internet connection. A handout about license requesting and installing ArcGIS Pro is posted in Moodle. If you need help on installing ArcGIS software to your computer, please directly contact IT to troubleshoot by means listed at https://www.umass.edu/it/support
- Alternative to the above, you can connect through UMass Azure Virtual Desktop and use ArcGIS pro installed on the server. It is not as stable as local installation. For students who need to request the remote desktop access (i.e.., Azure Virtual Desktop), please read here and submit a request. https://www.umass.edu/it/support/computer-classrooms/access-software-windows-virtual-desktop

ONLINE AND ASYNCRONOUS OPTION

In person attendance is strongly encouraged for this class. The class is designed with group work and interactions. For students cannot meet in person, the lectures and lecture recording will be accessible via zoom. All access links are provided in Moodle. The instructor and TA will help in person students during the lab session and might not be able to provide timely help to remote students. Remote students are encouraged to get help during the office hours.

GRADING SCHEME

	468	**668***		**468**	**668***
Labs	45%	45%	Quiz	10%	10%
Mid-term project	10%	/	Final project	30%	30%
Journal paper presentation	/	10%	Class participation	5%	5%

* In some labs, extra parts will be assigned to 668 students. 668 students are expected to give a journal paper presentation and finish a more complete final project.

Online I encourage everyone keep their video on at least part of the class time. If I have never seen your face throughout the semester, you will get a deduction on participation points.

POLICIES

1. **Attendance Policy** Attendance to the class is required in the normal circumstances. Students who are absent due to excusable extenuating circumstances remain responsible for obtaining any materials (i.e. notes) from other students, meeting all class requirements and contacting me in a timely fashion about making up missed work. Failure to meet course requirements will require documentation for alternate arrangements to be made.

2. All the assignments are required to submit to Moodle in WORD or PDF. Moodle allows the instructor to grant extension to individuals for special circumstances. Email the instructor and TA for excusable extension. **Any submission made by email attachment or link to your shared document will not be considered for grading and meeting deadline**. If you use Google document, you must download a copy in .docs or .pdf and upload to Moodle.

3. **Assignment late submission policy** Both *due date* and *late due date* are noted in each assignment. The *late due date* is normally 7 days after the *due date*. All exercises must be turned in by the hours the exercises are due. Each student has one chance of late submission with no point deduction during the semester. Other late submission before late due date without advance permission by the instructor will cause a grade deduction. **No lab assignment will be accepted after one week following the due date** unless arranged with the instructor before the deadline.

Late submission	24-72 hours (1-3 days)	72-168 hours (4-7 days)	>7 days
Point deduction	1/4	1/2	Not accepted

4. Missing mid-term project, final project presentation, final project report, or >=3 assignments will result in an F for the course, no matter what your final grade is.

5. **Academic Honesty Statement:** Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students

are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent.

(http://www.umass.edu/dean_students/codeofconduct/acadhonesty/).

6. **Disability Accommodation Statement**: The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. For disability accommodations, please register with Disability Services as early as possible. Meanwhile please notify me within the first two weeks of the semester so that we may make appropriate arrangements. DS accommodation request must be filed each semester. Do not expect the request will be automatically carried over.

Class schedule and reading are posted on <LINK>. This link is also provided in Moodle. Schedule will be updated with classes progressing. Lecture notes and assignments in PDF are posted in Moodle. Check your UMass email daily for class notices and announcement.

General			Vector	Raster	Spatial statistics
Week	**Class**	**Arrangement**	**Topic**		**Assignment/Reading**
1 Feb 6	Tu	Lec 0	Introduction		
	Th	Lec 1	Coordinate system and Projection revisit		Optional: Bolstad ch3
2 Feb 13	Tu	Lab 1	Projection (Define, convert projection, raster georeferencing)		Price p73-88
	Th	Lec 2	Geodatabase and Vector data model revisit		Optional: Bolstad ch2
3 Feb 20	Tu	Lab 2	Demo: I. Geodatabase schemas II. Editing with Topology III.Working with Geodatabase (Domain and Subtype)		Price p379-301
	Th	Lec 3 with in-class exercise	Vector Spatial Analysis (Spatial Query, Spatial Join, Overlay, Dissolve)		Optional: Bolstad ch9
4 Feb 27	Tu	Lab 3	Map Overlay and Geoprocessing		Price p289-300
	Th	Lab 4	Census data and Geocoding		Bolstad p301-303, p395-395
5 Mar 6	Tu	Lec 5.1	Raster Data Model		Bolstad ch10
	Th	Lec 5.2	Raster Spatial Analysis (local)		
6 Mar 13	TuTh		No class, spring break		
7 Mar 20	Tu	Lab 5.1	Raster Spatial Analysis (local functions) (in-class practice)		
	Th	Lec 5.3	Raster Spatial Analysis (focal, zonal, block) (possibly to be canceled as the instructor might be out for a conference)		
8 Mar 27	Tu	Lec 6	Terrain Analysis: TIN, topography surface, viewsheds		Bolstad ch11
	Th	Lab 5.2	Raster Spatial Analysis		Price p319-334
10 Apr 3	Tu	Lab 6	Terrain Analysis:, hillshade and Watershed Analysis Watershed delineation (In class practice)		Bolstad ch11
	Th	Lec and Lab 7	Other raster analysis: interpolation, cost analysis, density		
10 Apr 10	Tu	Lec 8	Point Pattern Analysis: Measure		Bailey & Gatrell ch3
	Th		**Mid-project**		
11 Apr 17	Tu	Lab 8	Point Pattern Analysis: Test Geographic distribution, Point Pattern Measure and test		
	Th		**Graduate student journal paper presentation**		
12 Apr 24	Tu	Lec 9	Spatial continuous data and area objects spatial autocorrelations test		Bailey & Gatrell ch5&7
	Th	Lab 9	Spatial continuous data and area data analysis **Final project proposal due on Friday**		
13 May 1	Tu	Working on final project			
	Th	Working on final project			
14 May 8	Tu	Working on final project			
	Th	Working on final project			