Geography 4103/5103
Introduction to Geographic Information Science

http://www.colorado.edu/geography/babs/geog_4103_f14/

Lectures Tues / Thurs 12:30 -1:45 GUGG 205
Labs Thurs 3:30-6:20; Fri 9-11:50 KESDA Lab (Gugg 6)

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Undergraduate lab assistants: Patrick Sine and Luke Schmitt

OVERVIEW: This course introduces concepts and use of Geographic Information Systems to analyze geospatial data. Emphasis is placed on the nature of geographic information, management of geospatial data, and how digital methods support geographic analysis and modeling. The course is intended for students who want a technical introduction to GISystems and GIScience. You'll learn how to import spatial data into a GIS database, how to organize data to detect and analyze spatial patterns, and basic skills for GIS query and map overlay. You'll work with mapping in a GIS environment. Lectures will introduce the conceptual and computational basis for GIScience. Lab exercises will give you lots of hands-on experience with GIS methods and data.

PREREQUISITES: A technical course in mapping skills (GEOG 3053) and a course in Introductory Statistics. I assume that you are comfortable with Windows, email and Internet, have basic experience with maps and charts, and have a basic understanding of map scale, map projections, and interpreting spatial patterns. I also assume you understand elementary descriptive statistics such as correlation, means, medians and quartiles, variance and residuals.

LECTURES: Lecture periods emphasize concepts, in-class discussions, and student participation. Some lectures will present case studies related to specific lab assignments; in others you will work on short in-class exercises, join small group problem-solving, or participate in class discussions on readings. Our goal is to synchronize lectures with labs as much as possible.

LABS: Labs meet every week including the first week of classes. Lab assignments are due at the beginning of lab session, except for exercises marked in the schedule. Late lab assignments will be docked 20% per day, beginning on the due date. Students must hand in all lab assignments by noon Monday 15 December 2014 to receive a passing grade, including any late lab assignments.

Students are required to back up their own data and assignments; we do not have reliable backup facilities available in KESDA. Purchase at least two flash drives (min 2GB) and dedicate them to this class – use one for backup. We'll show you how to use the flash drive to hand in assignments.

ATTENDANCE: Attendance will be taken at lecture; more than four unexcused absences during the term will lose four per cent off the final course grade for each missed class. An excused absence from lecture means written permission beforehand from babs.

Attendance is also required in labs. You must attend full lab periods to pass the class: you can't learn GIS if you don't do GIS. Four per cent will be taken off your final course grade for each missed lab, unless you have written permission in advance from babs or the TA. We collect and archive all permission emails.

READINGS:

REQUIRED Bolstad P. 2012. *GIS Fundamentals*. 4th Edition. White Bear Lake, Minnesota: Eider Press.
OPTIONAL Wade T and Sommer S. 2006. *A to Z GIS: An Illustrated Dictionary of Geographic Information Systems.* Redlands, CA, ESRI Press. (order from ESRI or Amazon)
Additional required readings will be available as pdf documents on the class website.

GRADING: The class grade is based on 300 points for undergraduates, and 350 points for graduates.

Lab Exercises (9)	150 points
Quizzes (4)	60 points
Readings abstracts (2 abstracts each from 3 sets)	30 points
In-Class exercises (6)	45 points
Ask Questions in Readings Discussions (4)	15 points

Graduate students will present one readings discussion (working in groups)	25 points
and collaboratively write a critical essay on the topic	25 points

READINGS ABSTRACTS: Students will submit three pairs of readings abstract assignments, writing two abstracts for each assignment (6 in all). Each abstract should be 200 words plus one question (that means 400 words plus two questions for each assignment), in Word (.doc or .docx) format. Abstracts must include a full citation for each article, using the format shown in this syllabus. A template for abstracts can be found on the class website. Hand the abstracts in a single Word document by email to babs before class on the due dates. Late abstracts will not be accepted.

READINGS DISCUSSIONS: Several times during the semester, the class will devote half a lecture period to discussing readings. Graduate students will work in groups to lead a readings discussion, preparing a Powerpoint presentation to be posted on the class website. The grad students will present the topic to the class and lead the discussion (max 30 min). Each grad student team is expected to meet with babs before their readings discussion for feedback on the material they are going to use. Each team will then write up a critical essay (2500 - 3000 words, i.e., 6-8 pages including graphics) about the topic they present. Additional instructions are available on the class website. Students who are not presenting on a given topic are expected to prepare for discussion periods by reading the assigned articles, and contribute questions and discussion. The essay is to be submitted to babs via email as a Word document no later than Monday 15 Dec, noon.

Readings Abstracts

11 Sept	Scale and Resolution in GIS: Tobler, Mandelbrot 1 and 2, Goodchild and Proctor, Shelberg et al 16 Sept: Readings Discussion in Class
16 Oct	Topology: Wissler, Theobald, Buttenfield 21 Oct: Readings Discussion in Class
4 Nov	GIS Applications in Natural and Social Sciences: Bibby & Shepherd, Aspinal 6 Nov: Readings Discussion in Class
13 Nov	Accuracy and Uncertainty: Beard, Comber et al, Fisher PF 18 Nov: Readings Discussion in Class
2 Dec	Geoslavery and Location Services: Dobson and Fisher, Honan, Klinkenberg, Fisher A. 4 Dec: Readings Discussion in Class

Please Note: I do not give make-up exams or make-up class exercises. I do not give incompletes.
Please turn off cell phones during class and labs.

Schedule for the Semester

	DATE	LECTURE	READING	LAB EXERCISE
1	26 A 28	Introduction GIS Components	Bolstad 1, 4(131-140,164-170); Goodchild	Lab 0 – KESDA intro and ArcGIS Tour
2	2 S 4	Case Study - Roadsalt Model The Nature of Spatial Data	Tobler, Mandelbrot- both Goodchild & Proctor	Lab 1 – Modeling Timber Due 11/12 S (15)
3	9 S 11	Spatial Resolution GPS	Shelberg Bolstad 4(159-161), 5, 6 ***Rdg abs #1 due 11 S (10)***	Lab 2 – Vector /Raster Query Due 25/26 S (15)
4	16 S 18	Raster and Vector Data 1 ***Rdgs Disc – Scale&Resl'n*** **Quiz #1: GIS Components, Scale, GPS (15)**	Bolstad 2,11	Lab 2 (con't.) GPS Data Collection
5	23 S 25	Raster and Vector Data 2 *Run-Length Ex (5)* Sinton Modeling, Flowcharts	 Sinton	Lab 3 GIS Scenarios Due 2/3 O (15)
6	30 S 2 O	Projections 1 Projections 2 *Tissot demo and mapping (5)*	UTM-SPC revu Bolstad 3, App. B	Lab 4 Build and Edit Data Due 9/10 O (15)
7	7 O 9	**Quiz #2: Raster-Vector, (15) projections, Sinton, queries** Feature Geometry 1	 Wissler; Theobald, Buttenfield	Lab 5 Scenario Building Due Fri 23/24 O (20)
8	14 O 16	Feature Geometry 2 Spatial Topology *DIME File Ex (10)*	 ***Rdg abs #2 due 16 O 10)***	Lab 5 (con't.)
9	21 O 23	***Rdgs Disc – Topology*** *Zonal Stats ex (5)* GIS Attributes *Modeling Operators Ex (10)*	Bolstad 9, 10	Lab 6 ModelBuilder Due 30 O / 1 N (10)
10	28 O 30	**Quiz #3: features, attributes, topology, modeling (15)** Case Study - Deer	NY Times Bolstad 7; Bibby; Aspinal	Lab 7 Greenspace Modeling Due 13/14 N (20)
11	4 N 6	Online Data Sources ***Rdgs Disc: GIS Applic'ns*** Data Uncertainty & Metadata	***Rdg abs #3 due 4 N (10)*** Bolstad 4 (171-175), 14 Rhind; Beard; Comber; Fisher PF	Lab 7 (con't.)
12	11 N 13	GIS Database Management 1 GIS Database Management 2	Bolstad 8 ***Rdg abs #4 due 13 N 10)***	Lab 8 Coastal Flooding Due 4/5 D (20)
13	18 N 20	***Rdgs Disc: Uncertainty*** GIS Database Management 3 *Relational Database Ex (10)*	 Dobson&Fisher; Honan; Klinkenberg, Fisher A	Lab 8 (con't.)
14	25 N 27	FALL BREAK – NO CLASS		NO LABS THIS WEEK
15	2 D 4	Case Study – Envir Justice ***Rdgs Disc: Geoslavery & Loc'n Services***	Mennis&Jordan ***Rdgs abs #5 due 2 D (10)***	Lab 9 Envir Justice Due Mon 15 Dec noon (20)
16	9 D 11	**Quiz #4: DBMS, GIS apps, uncertainty, geoslavery (15)** Class Summary: Other GIS classes, other prospects		Lab 9 (con't.) All labs due Mon 15 Dec noon ***Grad papers due Monday 15 Dec noon***

Xerox Readings

(available as pdfs on class website and some are on the web-at-large)

Aspinal, R 1999 GIS and Landscape Conservation. Chapter 69 in: Longley P., Goodchild MF, Maguire DJ, and Rhind DW (eds.). *Geographical Information Systems: Management Issues and Applications.* Wiley: 967-980.

Beard M.K. 1989. Use Error: The Neglected Error Component. *Proceedings of the Ninth International Symposium on Computer-Assisted Cartography (Auto-Carto 9)*, Baltimore, Maryland: 808–817.

Bibby PR and Shepherd JW 1999 Monitoring Land Cover and Land Use for Urban and Regional Planning. Chapter 68 in: Longley P., Goodchild MF, Maguire DJ, and Rhind DW (eds.). *Geographical Information Systems: Management Issues and Applications.* New York: Wiley: 953-965.

Buttenfield BP. 2002 Transmitting Vector Geospatial Data across the Internet. *Proceedings, GIScience2002.* Berline: Springer Verlag Lecture Notes in Computer Science #2478: 51-64.

Comber AJ, Fisher PF, Harvey F, Gahegan M, and Wadsworth R. 2006. Using Metadata to Link Uncertainty and Data Quality Assessments. *Proceedings, 12 Int'l. Symposium on Spatial Data Handling (Progress in Spatial Data Handling)*, Vienna, Austria, Springer-Verlag: 279-292.

Dobson, JE and Fisher, PF. 2003 Geoslavery. IEEE Technology and Society Magazine, Spring: 47-52.

Fisher A. 2014 Don't Ask Why. Ask Where. *New York Times Magazine*, 15 December 2013: 42-47, 73-75.

Fisher, PF. 1999 Models of Uncertainty in Spatial Data. Chapter 13 in: Longley P, Goodchild M F, Maguire D J, and Rhind D W (eds) *Geographical Information Systems: Principles, Techniques, Management and Applications* (Volume 1). New York, John Wiley and Sons: 191–205.

Goodchild, M.F. 2008 Geographic information science: the grand challenges. In J.P. Wilson and A.S. Fotheringham, Eds, *Handbook of Geographic Information Science.* Malden, MA: Blackwell: 596–608.

Goodchild, M.F. and Proctor, J. 1997 Scale in a Digital Geographic World. *Geographical and Environmental Modelling* 1(1): 5-23.

Honan, M. 2009 I Am Here. *Wired Magazine* 17(2):70-75.

Klinkenberg B. 2007. Geospatial Technologies and the Geographies of Hope and Fear. *Annals Association of American Geographers* 97(2): 350 - 360.

Mandelbrot BB. 1967 How Long is the Coast of Britain? Statistical Self-Similarity and Fractional Dimension. *Science* 156: 636-638.

Mandelbrot BB. 2010 Fractals and the Art of Roughness. TED Talk ("ideas worth spreading"), Feb 2010, posted July 6 2010 http://www.ted.com/talks/benoit_mandelbrot_fractals_the_art_of_roughness.html

Mennis, J and Jordan, L. 2005 The Distribution of Environmental Equity: Exploring Spatial Nonstationarity in Multivariate Models of Air Toxic Releases. *Annals Association of American Geographers*, 95(2): 249-268

New York Times 5 articles (Case Study #2): Deer in Buffalo NY; Pittsburgh PA; Princeton NJ; Front Royal VA; Cougar and Deer in Boulder CO

Rhind DW 1999 National and International Geospatial Data Policies. Chapter 56 in: Longley P., Goodchild MF, Maguire DJ, and Rhind DW (eds.). *Geographical Information Systems: Management Issues and Applications.* New York: Wiley: 767-787.

Shelberg M, Lam NSN, and Moellering H. 2013 Fractals 30 years After: A Retrospective of "Measuring the Fractal Dimensions of Surfaces". Chapter 18 in: Wellar, B (ed.) *AutoCarto Six Retrospective*. Ottawa Canada: Information Research Board: 134-140.

Sinton DF. 1978 The Inherent Structure of Information as a Constraint to Analysis: Mapped Thematic Data as a Case Study. In G.H. Dutton (Ed.), *Harvard Papers on Geographic Information Systems*, Vol. 7, Reading, Massachusetts: Addison-Wesley.

Theobald DM. 2001 Topology Revisited: Representing Spatial Relations. *International Journal of GIScience*, 15(8): 689-705.

Tobler WR. 1987 Measuring Spatial Resolution. *Proceedings*, International Workshop on Geographical Information Systems, Beijing, PRC, 25-28 May 1987: 42-47.

UTM_SPC overview Muehrcke, P. C. and Muehrcke, J.O. 1992 *Map Use: Reading, Analysis and Interpretation.* Madison, Wisconsin: JP Publications. 3rd Ed: 210 – 216.

Wissler C and Christopherson GL. 2007 Topology and Topological Rules: Geometric Properties Maintained in Spatial Databases. Lecture Notes for GIS in Natural Resources. *www.srnr.arizona.edu/rnr/rnr417/topology.pdf.*

Department of Geography Code of Conduct

In the Department of Geography, instructors strive to create an atmosphere of mutual trust and respect in which learning, debate, and intellectual growth can thrive. Creating this atmosphere requires that instructors and students work to achieve a classroom in which learning is not disrupted. At the most basic level, this means that everyone attend class, be prepared with readings and assignments completed, and that students pay attention. This means no conversations with friends, reading the newspaper, coming late, or leaving early without good reason. Such behavior is disruptive to the instructor and to your fellow classmates.

These basics of classroom etiquette are an important means of building and showing mutual respect. Inevitably, however, disagreements may arise. Sometimes these disagreements will be about content, sometimes about grades or course procedures, and sometimes they will be about the treatment of participants in the class. In order to facilitate the resolution of disagreements if they do arise, the following guidelines should be followed by everyone:

- All interactions must be guided by mutual respect and trust.
- If you are bothered by some aspect of the class, identify what bothers you and center the discussion on that issue.
- Address issues that concern you early. Problems are easier to resolve before they fester.
- Consider whether it is best to address your concerns in class or in a separate appointment with the instructor. Remember, behavior that disrupts your fellow classmates is not acceptable.
- Abusive speech or behavior will not be tolerated in any interaction between students or between student and instructor. If an instructor feels that your speech or behavior is abusive, you will be asked to leave the room. If you believe an instructor has become abusive, you may leave the room and talk with the department chairperson. Debate and discussion can continue when all parties proceed with mutual respect.
- If mutual respect cannot be restored, either you or the instructor may take the issue to the department chairperson or the Campus Ombuds Office.

Policy on Plagiarism

The College of Arts and Sciences has an Honor Code that prohibits plagiarism, cheating, fabrication, aiding academic dishonesty, lying, bribery, and threats at the University of Colorado. A key element of this code is that CU students will not plagiarize which means you may not use someone else's words, pictures, ideas, or procedures as your own. In some instances, it is appropriate to do so when you provide proper acknowledgement. Cases of plagiarism and violations of the CU Honor Code will not be tolerated. More information can be found online at http://www.colorado.edu/academics/honorcode/, particularly under the "Student Information, What is a Violation?" section.

Policy on Concealed Weapons in the Classroom

Following the Colorado Supreme Court's ruling in March 2012 that the CU Board of Regents lacks the authority to regulate concealed weapons on campus under the Colorado Concealed Carry Act, let me clarify my personal position on concealed carry permits and weapons in my classroom. What this ruling means is that anyone is permitted by law to bring a concealed weapon into a classroom if they also bring in the concealed carry permit, and so long as the weapon remains concealed. According to this ruling, I cannot prohibit concealed weapons in my classroom. And if you have a concealed carry permit, I can't insist that you tell me about it. In truth, I would rather not know, so that your right to carry a concealed weapon does not interfere with my obligation to grade you objectively. I can request however that out of respect for my and others' concerns, I prefer that you leave your weapons out of my classroom and out of my office. I respect your decision either way.