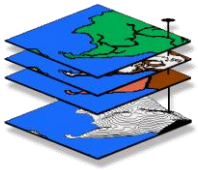


GIS Modeling Syllabus

…an introduction to grid-based map analysis and modeling

GEOG 3110, University of Denver, Geography, Winter Term 2010
Thursdays 6:00-8:50 pm, GIS Lab, Room 125, Boettcher (West)

<*Class website* *is posted at* http://www.innovativegis.com/basis/Courses/GMcourse10/>
<*This* ***Syllabus*** *is posted at* http://www.innovativegis.com/basis/Courses/GMcourse10/Syllabus/>
<*Click here for a printer-friendly version of this Syllabus*>

Instructor:

Joseph K. Berry, Room 240 Boettcher West, phone 970-215-0825

About the instructor: http://www.innovativegis.com/basis/basis/cv_berry.htm
Email: jkberry@du.edu; Website: http://www.innovativegis.com/basis
Office hours Thursdays 3:00 to 5:00pm (or as specially arranged on Fridays)
By phone, business hours Monday through Friday — by email, anytime

Course Materials:

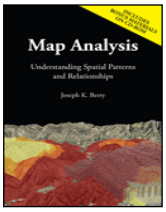
Course Text is *Map Analysis: Understanding Spatial Patterns and Relationships* (Berry, 2007) available at an author's discount at the first class meeting ($34.64 or order from www.geoplace.com/books/mapanalysis for $51.95, includes U.S shipping). The book includes a ***Companion CD*** including software Further Readings, Example Applications, Software and Exercises…
http://www.innovativegis.com/basis/Books/MapAnalysis/Default.htm

Course Materials including lecture notes, exercises and readings are posted on the ***Class Website*** at…
http://www.innovativegis.com/basis/Courses/GMcourse10/

Course Description:

This intermediate course focuses on the concepts and procedures used in discovering and applying the spatial relationships within and among maps. It extends the mapping and geo-query capabilities of GIS technology to map analysis and construction of spatial models. The course establishes a comprehensive framework that addresses a wide range of applications from natural resources to geo-business *…within "a map-ematical structure."*

Topics include the *Nature of Mapped Data*, *Spatial Analysis* and *GIS Modeling* in the first six weeks followed by *Surface Modeling* and *Spatial Data Mining* operations in the ensuing four weeks. The lectures, discussions and lab exercises provide a foundation for creative application of GIS technology in spatial reasoning and decision-making *…"thinking with maps."*



The course uses Dr. Berry's book *Map Analysis: Understanding Spatial Patterns and Relationships* (GeoTec Media, 2007).
www.innovativegis.com/basis/Books/MapAnalysis/Default.htm for more information about the book

Application areas addressed in the course include Natural Resources *(Habitat Mapping, Wildfire Risk, Visual Exposure Impacts, Accessibility)*, Precision Agriculture *(Soil Nutrient Mapping, Yield Analysis, Fertility Program Optimization, Erosion Potential)*, Infrastructure *(Routing and Optimal Paths, Risk Analysis, Consensus Building)*, Geo-Business *(Store Siting, Competition Analysis, Retail sales Forecasting, Commercial Properties Investment)* and numerous other examples draw on the instructor's consulting, presentations and research projects.

Course Objectives:

Students will develop spatial reasoning skills necessary in flowcharting and implementing GIS solutions. The understanding of grid-based analytical operations and fundamental approaches used in descriptive, predictive and prescriptive mapping extends existing courses in data encoding, management and software usage. Students who are most successful in this course will be able to demonstrate:

- ✓ an understanding of the differences between data processing in discrete and continuous space
- ✓ an awareness of spatial dependency within and among mapped data and its effect on map analysis
- ✓ a working knowledge of basic spatial interpolation and statistics procedures
- ✓ a working knowledge of grid-based spatial analysis operations to include visual analysis, effective distance, optimal path density, terrain analysis, contextual summaries and edge/shape/pattern characterization, and
- ✓ an ability to flowchart and implement GIS models.

Topics and Schedule:

Week	Topic
1 1/7	**Overview**: GIS mapping, management and modeling; Discrete (map objects) vs. continuous (map surfaces); Linking data and geographic distributions; Framework for map-*ematical* processing
2 1/14	**Maps as Data:** Map data types and their implications; Contouring implications; Characterizing size, shape, pattern and arrangement
3 1/21	**Reclassifying and Overlaying Data Layers:** Point, region and map-wide overlay; Grid math; Spatial coincidence statistics; Comparing maps; Error propagation
4 1/28	**Measuring Distance and Connectivity:** Simple vs. weighted distance; Proximity and movement; Accumulation surfaces; Identifying optimal path(s); Viewsheds and visual exposure surfaces; Narrowness surfaces
5 2/4	**Summarizing Spatial Context:** Calculating slope, aspect and profile maps; Applying spatial differentiation and integration; Roving window summary operations; Characterizing edges and complexity
6 2/11	**GIS Modeling Approaches:** Deductive vs. inductive reasoning; Flowcharting spatial problems; Types of GIS models ***** online Exam #1 — covers week 1-5 material *****
7 2/18	**GIS Modeling Examples:** Pipeline routing; Wildfire risk mapping; Micro-terrain analysis; Retail sales prediction
8 2/25	**Surface Modeling:** Basic statistics and its GIS expression; Spatial dependency, Spatial interpolation (IDW, Kriging and others); Assessing interpolation results; Mapping spatial dependency; Sampling design
9 3/4	**Spatial Data Mining:** Linking numeric and geographic patterns; Normalizing maps; Viewing scatter plots; Clustering mapped data; Investigating map correlation; Developing prediction models; Assessing prediction results
10 3/11	**Future Directions:** Dynamic map pedigree; Toward a humane GIS; GIS software's changing roles; Evolving the GIS mindset; Is technology ahead of science?; Multimedia Mapping; Map Display
Finals Week	***** online Exam #2 — covers weeks 6-10 material *****

Prerequisites:

An introductory course in GIS (recommended) or instructor permission is required for enrollment. Familiarity with basic statistical concepts, general computer skills and interest in quantitative analysis are helpful.

Course Format:

The class meets once a week for three hours. Class meetings involve lecture, discussion and real-time demonstrations of concepts in spatial statistics, spatial analysis and GIS modeling using *MapCalc* and *Surfer* software. Student teams will complete homework exercises (approximately six hours per week)

outside of class using Geography lab facilities or software installed on student's personal computer. The operations used in the exercises are cross-referenced to the ArcGIS Grid and Spatial Analyst commercial systems. Students are expected to remain current on reading assignments (approximately two hours per week) and be prepared to contribute to class discussions.

Guidelines for Preparing and Submitting Homework Assignments

Homework assignments use course software to address a series of questions that demonstrate GIS modeling concepts, procedures, considerations, applications and issues. The questions form a *Word* template for the lab report you will prepare as teams. You are encouraged to use screen captured images and embed them as figures that structure your answer. Your responses should be as succinct as possible while developing clear and complete answers to the questions.

Submission and Grading: Store your completed exercises as *Word* documents (*.doc* file) and place into the *Class Blackboard Dropbox* as demonstrated in class. Do not worry about page breaks or other printer formatting as all exchange of the labs will be in electronic **Web Layout View** format. Grading will use the "*Track changes*" tool in *Word* to make comments, grade and then return the document.

Homework assignments are **due by 5:00pm on Friday following the class** (nine days to complete). This provides an opportunity to address questions via email and during the instructor's office hours.

Homework exercises will be completed in two to three member teams. To help keep track, please name your homework files with the exercise number followed by the team member names separated by an underscore (e.g., **Exercise0_Berry_Smith_Jones.doc**). The extension "_graded" will be added when it is graded and returned to each of the members on the team.

The homework exercises represent over half of your grade (7 Lab reports plus 1 Project report = 350 + 150= 500 of 900 total points). A high degree of professionalism in preparing your lab and project reports is expected. One of the seven weekly lab reports can be completed as a PowerPoint presentation and one of the reports can be skipped (student discretion; grade will use overall average of other homework exercises for grading points).

Policies and Expectations:

Students are expected to attend class regularly. Class lectures, discussion and demonstrations are an important part of the course that is difficult to reconstruct. Excused absences include illness, death in the family or participation in a DU sanctioned event. If you must miss class, please notify the instructor **prior** to the class meeting so arrangements for make up of the material missed can be made.

Unexcused late homework assignments without prior notification receive a maximum possible of 45 points (10% penalty) if turned in before to the next class meeting and will not be accepted (0 points) if more than one week late. There are no make-up exams except for excused absences with prior notification. Students may review their current grade at anytime during office hours; periodic summaries will be emailed.

Method of Evaluation:

Grades for the course will be determined as follows:

Attendance and Participation (10 classes worth 10 points each)	100
Homework Exercises (7 assignments worth 50 points each)	350
GIS Modeling Project (Week 7)	150
Exam 1 (Week 6)	150
Exam 2 (Finals week)	150
Total Points	900

Points earned are cumulative and translate into a letter grade according to the following scale:
A+ 97-100, A 93-97%, A- 90-93%, B+ 87-90%, B 83-87%, B- 80-83%, C+ 77-80%,
C 73-77%, C- 70-73%, D+ 67-70%, D 63-67%, D- 60-63%, F 0-60% (tie goes to the student)

Note: Up to **100 Optional/Extra Credit Points** are available for students wanting to pursue a topic in greater detail or increase their grade.

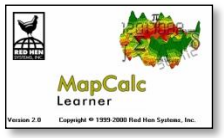
Course Software

All of the course software is installed on the GIS Lab computers. You can install the software to your own computer from the Map Analysis book's companion CD or download from the Internet—

Microsoft Office [you need to have working versions of Microsoft Office applications *Word*, *PowerPoint* and *Excel* loaded on your computer]

Adobe Reader [**download and install** from the Internet — Windows-based program for viewing/printing documentation files (.pdf); free software; see www.adobe.com/products/acrobat/readstep2.html for more information on Adobe Reader and free download]

SnagIt [**download and install** from the Internet — screen capture software; 30 day evaluation; see www.techsmith.com/ for information on fully licensed system ($37.95 Academic version)]



MapCalc Learner [install from the Map Analysis book **Companion CD** — grid-based map analysis software included with the course materials provided by the instructor]

Surfer Demo [install from the Map Analysis book **Companion CD** — surface modeling and 3D display software included with the course materials provided by the instructor; also can download from www.goldensoftware.com/demo.shtml; see www.goldensoftware.com and select "Products→ Surfer" for more information on fully licensed system ($699)]
