GEOG 481/581: GEOGRAPHIC INFORMATION SCIENCE 1

Instructor: Hedda R. Schmidtke
Lecture: 9:00-9:50 M, W
Labs: 2hrs/ week

TEXTBOOKS

P. A. Longley, M. F. Goodchild, D. J. Maguire, and D. W. Rhind. *Geographic information science and systems (4th edition)*. John Wiley & Sons, 2015.

COURSE DESCRIPTION

This course is the first part of a series which teaches Geographic Information Science, its methods, history, and areas of current research. GIScience 1 focuses on the mathematical fundamentals underlying the representation of geographic information and on the computational framework that is required for storing and processing massive amounts of geographic information. It is a prerequisite for GEOG 482/582 GIScience 2, which explores uncertainty handling and spatial analysis and GEOG 491/591 Advanced GIS.

EXPECTED LEARNING OUTCOMES

After completing the course students

- Understand the mathematical fundamentals underlying geographic coordinate systems and other geographic reference systems
- Are able to critically evaluate maps and GI systems output in a scientific way
- Can analyze and visualize geographic data sets using GI systems tools
- Understand the role and function of the technical components of current GI systems, as well as their historical roots

ESTIMATED STUDENT WORKLOAD

The course contains lectures, reading assigments, and in-class activities/quizzes, as well as lab assignments, including a final project. Students spend two hours in lectures and two hours in labs. Each lecture consists of 30 mins of presentation by the instructor and 20 mins of in-class activities. Presentations are interleaved with in-class activities, in order to allow students to actively engage with concepts and to make theoretical material tangible with hands-on experience. In-class activities include short quizzes, discussion group exercises, and mapping excercises. Assignments deepen the practical part of the learning experience enabling students to apply the presented concepts so as to reach learning objectives. Assignments practice the main steps for deriving a geospatial analysis and visualization using GIS tools. Students are expected to spend about eight hours per week on assignments: two hours in labs and on average six hours outside of classroom. Another two hours outside of classroom are required for course readings.

GRADING

GEOG 481:
Examinations (30%): mid term (10%), final (20%)
Final project (30%)
Lab assignments (30%): seven labs at 20-40 points (sum 200 points = 20%), one lab at 100 points (= 10%)
In-class activities (10%)

GEOG 581
The criteria for 581 students differ mainly in the requirements for the final project, which needs to be described in a short research paper (5-10 pages), and the requirement for a literature review (discussion of 5-10 scientific articles discussing a topic from the lectures at more depth). The distribution schema for GEOG 581 students is:
Examinations (22.5%): mid term (7.5%), final (15%)
Literature review (10%)
Final project (40%): project (300 points = 22.5%), write-up & method (200 points = 15%)
Lab assignments (22.5%): seven labs (sum 200 points = 15%), one lab at (100 points = 7.5%)
In-class activities (7.5%)

GRADING RUBRIC
Grading criteria follow http://gradeculture.uoregon.edu:
A+ Only used when a student's performance significantly exceeds all requirements and expectations for the class. Typically very few to no students receive this grade.
A Excellent grasp of material and strong performance across the board, or exceptional performance in one aspect of the course offsetting somewhat less strong performance in another. Typically no more than a quarter of the students in a class receive this grade, fewer in lower-division classes.
B Good grasp of material and good performance on most components of the course. Typically this is the most common grade.
C Satisfactory grasp of material and/or performance on significant aspects of the class.
D Subpar grasp of material and/or performance on significant aspects of the class.
F Unacceptable grasp of material and/or performance on significant aspects of the class.
The following expectations regarding point ranges are applied:

A+	98%+
A	95%-97%
A-	90%-94%
B+	87%-89%
B	83%-86%
B-	80%-82%
C+	77%-79%
C	73%-76%
C+	70%-72%

Grading in basic activities, such as examinations and lab assignments, evaluates in how far an answer reflects that the question with its background was understood and solved following the methods to be applied in the specific answer. Grading of advanced activities with higher degrees of freedom, such as advanced labs, the final project, or literature reviews, additionally evaluates the suitability of the choices made, e.g. the project plan, the method chosen for analysis, the choice of articles selected for review. Students should make sure that they seek guidance early for these tasks so as to actively discuss alternatives and should justify their choices in write-ups.

COURSE SCHEDULE AND ASSIGNMENTS

WEEK 1

Lecture 1
INTRODUCTION TO GI SCIENCE,
Reading: Longley et al. (2015), Chapter 1-1.5.6 (pp. 1-30)
Lecture 2
GEOSPATIAL DATA ,
Reading: Longley et al. (2015), Chapter 1.6-2.5 (pp. 30-43)
Lab 1
Work session: Map of Oregon

WEEK 2

Lecture 3
SPATIAL DATA CONCEPTS,
Reading: Longley et al. (2015), Chapter 2.6-3.5.2 (pp.43-66)
Lecture 4
SAMPLING,
Reading: Longley et al. (2015), Chapter 3.6-3.9 (pp.66-76)
Lab 2
Work session: Projections

WEEK 3

Lecture 5
PLACE NAMES & REFERENCE SYSTEMS,
Reading: Longley et al. (2015), Chapter 4.1-4.7 (pp.77-86)
Lecture 6
GEOMETRIES,
M. Pitici, Non-Euclidean Geometry Online: http://www.math.cornell.edu/~mec/mircea.html
Lab 3
Work session: Data Types

WEEK 4

Lecture 7
PROJECTIONS,
Reading: Longley et al. (2015), Chapter 4.7-4.8 (pp.88-91)
Lecture 8
COORDINATE SYSTEMS,
Reading: Longley et al. (2015), Chapter 4.8.1-4.9 (pp.91-95)
Lab 4
Work session: Selection and Filters

WEEK 5

Lecture 9
GEOREFERENCES
Reading: Longley et al. (2015), Chapter 4.10-4.13 (pp.95-98)
Lecture 10
Midterm, Reading: week 1-4
Lab 5
Work session: Tsunami Planning

WEEK 6

Lecture 11
SPATIAL DATA MODELS: HISTORY AND BACKGROUND,
Reading: Longley et al. (2015), Chapter 7.1-7.2.1 (pp. 152-155)
Lecture 12
SPATIAL DATA MODELS: RASTER, VECTOR, AND OBJECT MODEL,
Reading: Longley et al. (2015), Chapter 7 (pp. 155-172)
Lab 6
Work session: Raster Data: Elevation

WEEK 7

Lecture 13
DATA COLLECTION: UNCERTAINTY AND MEASUREMENT,
Reading: Longley et al. (2015), Chapter5.1-5.3.1 (pp. 99-112), Chapter 8.1-8.2.2 (pp. 173-181)
Lecture 14
DATA COLLECTION FROM OTHER SOURCES,
Reading: Longley et al. (2015), Chapter 8 (pp. 181-193)
Lab 7
Work session: Attribute Join and Spatial Clipping

WEEK 8

Lecture 15
GEODATABASES: INTERNAL STRUCTURE AND DESIGN,
Reading: Longley et al. (2015), Chapter 9 (pp. 194-206)
Lecture 16
GEODATABASES: INDEXING AND TRANSACTIONS,
Reading: Longley et al. (2015), Chapter 9 (pp. 206-216)
Lab 8
Introduction: Final Project

WEEK 9

Lecture 17
MAPS AND CARTOGRAPHY,
Reading: Longley et al. (2015), Chapter 11.1-11.2.1 (pp. 237-246)
Lecture 18
MAP DESIGN,
Reading: Longley et al. (2015), Chapter 11.3-11.6 (pp. 246-265)
Lab 9
Work session: Final Project

WEEK 10

Lecture 19
Presentations,
Reading: final projects
Lecture 20
Final Examination Q & A,
Reading: week 1-10
Lab 10
Work session: Final Project