GEOG 377: An Introduction to Geographic Information Systems

(Fall, 2007)

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Instructor:
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Course Websites:
General Information: http://solim.geography.wisc.edu/axing/teaching/geog377/index.html
Lecture and lab materials: Learn@UW

Schedule and Location:

Lecture Hours:
Tues. and Thurs. 4:00 p.m. - 5:15 p.m. (180 Science Hall)

Lab Hours:

See *Lab Syllabus*

Office Hours:
Instructor:
Tues. 2:30 p.m. – 3:30 p.m.
Thurs. 2:30 p.m. – 3:30 p.m.
T.A.:
See *Lab Syllabus*

1. Description:

Geographic Information Systems (GIS) deals with the analysis and management of geographic information. This course offers an introduction to methods of managing and processing geographic information. Emphasis will be placed on the nature of geographic information, data models and structures for geographic information, geographic data input, data manipulation and data storage, spatial analytic and modelling techniques, and error analysis.

The course is made of two components: lectures and labs. In the lectures, the conceptual elements of the above topics are explained. The labs are designed in such a way that students will gain first-hand experience in data input, data management, data analyses, and result presentation in a geographical information system.

Students must be clear that this is not a class on ArcGIS or any specific GIS software. It is a course on the underpinng theory and concepts in GIS. The understanding of these concepts and theories will help you to perform spatial analysis in a GIS system properly and better.

2. Objectives:

In general, this is an ice-breaking course into GIS and serves as the foundation course for other advanced courses in GIS. The basic objectives of this course for students are:

1) To understand the basic structures, concepts, and theories of GIS.
2) To gain a hand-on experience with daily routines of GIS operations.

3. Prerequisites:

Introductory courses in environmental or mapping sciences or instructor consent.

4. Computing Environment and Software:

ArcGIS (both the vector and the raster components) will be used for class assignments to illustrate the practical use of certain geographic information processing concepts and techniques.

5. Grading:

5.1 Components:

Exercises	40%
Exam One	30%
Exam Two	30%

5.2 Grading policy:

Grades of exercises are based on:

1) academic merit of your answers to the questions
2) conciseness of answers. ***NO BEATING AROUND THE BUSH***
3) organization of presentation. No one wants to flip through a messy assignment report looking for answers. Here is a general format for your presentation:

Question:

Your answer and discussion

Your support documents (images, graphs, tables, etc.)

The grade for each of the exercises and examinations is reported as ***points_scored*** / ***total_points_of_exercise***. For example, if an assignment is worth 20 points and your answers score 16 points then you should see ***16/20*** on your marked assignment.

5.3 Due date and time:

Each of the assignments will have a due day clearly written under the title of the assignment. The due time is the beginning of the lab session on the due day. Any assignment that is turned in after the due time on the due day is considered late. As you know, late assignments will receive penalty.

5.4 Penalty for late assignments:

The penalty for a late assignment is based on the number of days late (including weekends). If an assignment is late less than 24 hours, it is considered 1 day late. If an assignment is late less than 48 hours but more than 24 hours, it is considered 2 days late, and so on. Late assignments are penalized 10% per day. Here is the formula for calculating the points of a late assignment:

Points_get = Points_scored - 0.1*num_days_late*Points_scored

The minimum value of *Points_get* is 0. Assignments handed in after the TA has returned the graded assignment to class (usually a week after the due date) will receive ***no points***.

6. Other Important Issues:

This class is always full at the beginning of each semester and there are people waiting to get into the class. Those of you who are registered for this class but fail to show up in the first week of classes (unless I am notified ahead of time!), I will have to remove your name from the class list and make the space available for the people on the waiting list.

Sickness often gets in the way of completing assignments, particularly after a long weekend. If sickness is used as an excuse for turning in an assignment later or missing an examination, we (the TA and the instructor) need to see a written report from a medical doctor stating your inability to attend class and/or to complete an assignment.

We will certainly give you ample time to complete each assignment. There is no reason for us to be told that the computer is down or the software is not working a day before the assignment is due. This will ***NOT*** be taken as an excuse for a late assignment!

7. Course Materials:

7.1 Text:

Longley P.A., M.F. Goodchild, D.J. Maguire, D.W. Rhind, 2005. *Geographic Information Systems and Science*. John Wiley and Sons, New Jersey, 517 p.

7.2 Other key texts:

Aronoff, Stan, 1989. *Geographic Information Systems: A Management Perspective*, WDL Publications, Ottawa, 294 p.

Bonham-Carter, Graeme F., 1994. *Geographic Information Systems for Geoscientists*, New York, Pergamon, 398 p.

Burrough, P.A. and Rachael A. McDonnell, 1998. *Principles of Geographic Information Systems.* New York: Oxford University Press, 333 p.

Chang, K.T., 2008. *Introduction to Geographic Information Systems*. McGraw Hill, New York, 450 p.

Lo, C.P. and A.K.W. Yeung, 2002. *Concepts and Techniques of Geographic Information Systems*, Prentice Hall, Upper Saddle River, New Jersey, 492 p.

7.3 Other texts:

Bernhardsen, Tor, 1992. *Geographic Information Systems*. Longum Park, Norway: Viak IT, 318 p.

Berry, Joseph K., 1993. *Beyond Mapping: Concepts, Algorithms, and Issues in GIS*. GIS World Books, Fort Collins, Colorado, 246 p.

Clarke, Keith C., 2001. *Getting Started with Geographic Information Systems*. Prentice Hall, Upper Saddle River, New Jersey, 352 p.

Clarke, Keith C. 1990. *Analytical and Computer Cartography*. John Wiley and Sons, New Jersey, 290 p.

Chrisman, Nicholas R., 2002. *Exploring Geographic Information Systems*, John Wiley & Sons, New Jersey (Second Edition).

DeMers, M.N., 2003. *Fundamentals of Geographic Information Systems*. John Wiley & Sons, New Jersey, 486 p.

Longley, Paul and Graham Clarke (eds.), 1995. *GIS for Business and Service Planning*. GeoInformation International, Cambridge, 316 p.

Maquire, D.J., Michael F. Goodchild, and David Rhind, 1991. *Geographical Information Systems: Principles and Applications (volume 1 and 2)*. New York: Longman Scientific & Technical.

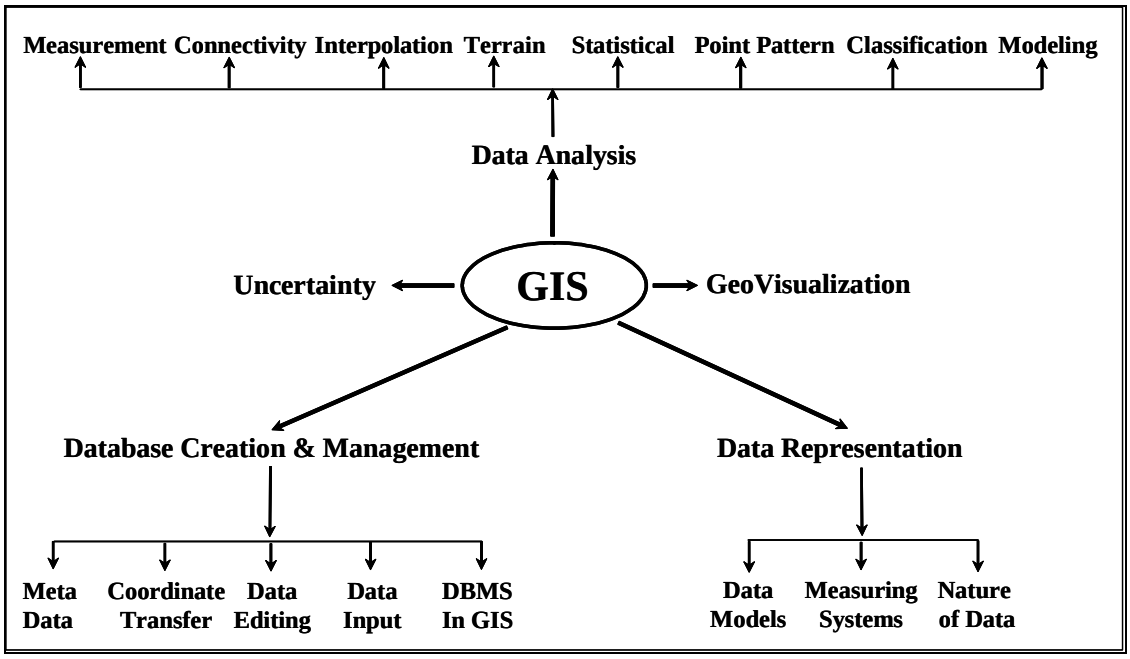
Martin, David, 1996. *Geographic Information Systems*: *Socioeconomic applications*. Routledge, New York, 210 p.

Star, Jeffry; and Estes, John. 1990. *Geographic Information Systems: An Introduction*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 303 p.

Tomlin, Dana. 1990. *Geographic Information Systems and Cartographic Modeling*. Englewood Cliffs, N.J.: Prentice Hall, 249 p.

8. Intended Topics:

8.1. An Overview:



8.2 Intended Lectures:

Lecture 1: (Sept. 4)

Introduction (I)

GIS: System v.s. Background

Introduction to Geog. 377

Lecture 2: (Sept. 6)

Introduction (II)

The nature of geographical information

What is GIS

Lecture 3: (Sept. 11)

Data Representation (I)

Measuring Systems

Location: coordinate systems

Lecture 4: (Sept. 13)

Data Representation (II)

Measuring Systems (continued…)

Topology: Basic geometric elements

Attributes: data types

Data in Computers

Lecture 5: (Sept. 18)

Data Representation (III)

Data Models:

Introduction: data models: spatial and attribute

Spatial Data Models:

Raster Data Models

Lecture 6: (Sept. 20)
Data Representation (IV)
Data Models:
Spatial Data Models:
Relational Data Models (for attributes)
Vector Data Models I

Lecture 7: (Sept. 25)
Data Representation (V)
Data Models:
Spatial Data Models:
Vector Data Models II

Lecture 8: (Sept. 27)
Data Representation (VI)
Data Models:
Spatial Data Models:
TIN:
Summary of Spatial Data Models (Raster v.s. Vector and TIN)

Lecture 9: (Oct. 2)
Data Representation (VII)
Summary of Data Models:
Linking attribute data with spatial data
Recent Development of Data Models

Lecture 10: (Oct. 4)
GIS Database Creation and Maintenance (I)
Data Input (spatial and thematic)
Data Editing (spatial and thematic)

Lecture 11: (Oct. 9)
GIS Database Creation and Maintenance (II)
Coordinate Transformation
Resampling (image data)
Address matching

Lecture 12: (Oct. 11)
GIS Database Creation and Maintenance (III)
DBMS and its use in GIS

Lecture 13: (Oct. 16)
GIS Database Creation and Maintenance (IV)
Metadata
Database creation Guidelines
NSDI

***Review Session**: (Oct. 18)*

Exam One: (75 minutes) (Oct. 23)

Lecture 14: (Oct. 25)
Data Analysis (I)
Measurement operations
Connectivity operations

Lecture 15: (Oct. 30)
Data Analysis (II)
Interpolation operations

Lecture 16: (Nov. 1)
Data Analysis (III)
Digital terrain analysis

Lecture 17: (Nov. 6)
Data Analysis (IV)
Statistical operations
Point Pattern Analysis

Lecture 18: (Nov. 8)
Data Analysis (V)
Classificaiton

Lecture 19: (Nov. 13)
Data Analysis (VI)
GIS-Based Modeling and Spatial Overlay: part I

Lecture 20: (Nov. 15)
Data Analysis (VII)
GIS-Based Modeling and Spatial Overlay: part II

Lecture 21: (Nov. 20)
Data Analysis (VIII)
Data Analysis Summary - Spatial Queries
Uncertainty

Lecture 22: (Nov. 27)
Geo-representation and geo-presentation
GeoVisualization

Lecture 23: (Nov. 29)
Spatial Modeling with GIS I
Application in Physical Geography

Lecture 24: (Dec. 4)
Spatial Modeling with GIS II
Application in Human Geography

Lecture 25: (Dec. 7)
Establishing A GIS Site

Review Session : (Dec. 11)

Exam Two: (75 minutes) (Dec. 13)