GEOG 377: An Introduction to Geographic Information Systems  
(Spring, 2006)  

Instructor:  
A-Xing Zhu, 255 Science Hall, Phone: 262-0272, azhu@wisc.edu

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. 1:15 p.m. – 2:15 p.m.  
Thurs. 1:15 p.m. – 2:15 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 underpining 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, and an introductory course in computer science (Comp Sci 110 or Comp Sci 132) or equivalent.

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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercises</td>
<td>40%</td>
</tr>
<tr>
<td>Exam One</td>
<td>30%</td>
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<tr>
<td>Exam Two</td>
<td>30%</td>
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</tbody>
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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 $\frac{\text{points scored}}{\text{total points of exercise}}$. For example, if an assignment is worth 20 points and your answers score 16 points then you should see $\frac{16}{20}$ 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:

$$\text{Points}_{\text{get}} = \text{Points}_{\text{scored}} - 0.1 \times \text{num}\_\text{days}\_\text{late} \times \text{Points}_{\text{scored}}$$

The minimum value of $\text{Points}_{\text{get}}$ 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:


7.2 Other key texts:


7.3 Other texts:


8. Intended Topics:

8.1. An Overview:

8.2 Intended Lectures:

Lecture 1: (Jan. 17)
Introduction (I)
    An example of GIS application
    Introduction to Geog. 377

Lecture 2: (Jan. 19)
Introduction (II)
    The nature of geographical information
    What is GIS

Lecture 3: (Jan. 24)
Data Representation (I)
    Measuring Systems
        Location: coordinate systems

Lecture 4: (Jan. 26)
Data Representation (II)
    Measuring Systems (continued…)
        Topology: Basic geometric elements
        Attributes: data types
        Data in Computers

Lecture 5: (Jan. 31)
Data Representation (III)
    Data Models:
        Introduction: data models: spatial and attribute
        Aspatial Data Models: Relational Tables

Lecture 6: (Feb. 2)
Data Representation (IV)
Data Models:
Spatial Data Models:
    Raster Data Models
(Demo of raster data models and computer display of raster image)

Lecture 7: (Feb. 7)
Data Representation (V)
Data Models:
    Spatial Data Models:
        Vector Data Models I

Lecture 8: (Feb. 9)
Data Representation (VI)
Data Models:
    Spatial Data Models:
        Vector Data Models II
        (Demo of vector data models)

Lecture 9: (Feb. 14)
Data Representation (VII)
Data Models:
    Spatial Data Models:
        TIN:
            Summary of Spatial Data Models (Raster v.s. Vector and TIN)

Lecture 10: (Feb. 16)
Data Representation (VIII)
Summary of Data Models:
    Linking attribute data with spatial data
    Recent Development of Data Models
    (Demo of data models in computer)

Lecture 11: (Feb. 21)
GIS Database Creation and Maintenance (I)
Data Input (spatial and thematic)

Lecture 12: (Feb. 23)
GIS Database Creation and Maintenance (II)
Data Editing (spatial and thematic)

Lecture 13: (Feb. 28)
GIS Database Creation and Maintenance (III)
Coordinate Transformation

Lecture 14: (March 2)
GIS Database Creation and Maintenance (IV)
DBMS and its use in GIS

Lecture 15: (March 7)
GIS Database Creation and Maintenance (V)
Metadata
Database creation Guidelines
NSDI

Lecture 16: (March 9)
Data Analysis (I)
  Introduction
  Spatial Queries
  Classification of GIS analytical functionality

Spring Recess (March 11 through March 19)

Lecture 17: (March 21)
  Review Session

Lecture 18: (March 23)
  Exam One (75 minutes)

Lecture 19: (March 28)
  Data Analysis (II)
    Measurement operations
    Connectivity operations

Lecture 20: (March 30)
  Data Analysis (III)
    Interpolation operations

Lecture 21: (April 4)
  Data Analysis (IV)
    Digital terrain analysis

Lecture 22: (April 6)
  Data Analysis (V)
    Statistical operations
    Point Pattern Analysis

Lecture 23: (April 11)
  Data Analysis (VI)
    Spatial Overlay

Lecture 24: (April 13)
  Uncertainty

Lecture 25: (April 18)
  Geo-representation and geo-presentation
  GeoVisualization

Lecture 26: (April 20)
  Spatial Modeling with GIS I
    Application in Physical Geography

Lecture 27: (April 25)
  Spatial Modeling with GIS II
    Application in Human Geography

Lecture 28: (April 27)
  Establishing A GIS Site

Lecture 29: (May 2)
  Review Session

Lecture 30: (May 4)
  Exam Two (75 minutes)