The Applications of GIS are endless…

**Reporting and Dissemination**
GIS facilitates delivering the results of environmental work in an efficient and professional manner.

**Analysis**
Location-based data can be analyzed to reveal trends across geographic areas.

**Crime Analysis**
"Geographic crime analysis enhances the efforts of our officers on the street and helps them do a better job."
Chief Tom Canaday, Lincoln, Nebraska Police Department

**Oceanography**
Researchers, organizations, and professionals are using GIS to develop marine applications to help understand and analyze this dynamic environment.

**Disaster Management**
GIS supports all aspects of disaster management—planning, response and recovery, and records management.

**Data Management**
Database-driven map production systems allow you to create representations of the data for multiple product outputs.

**Research**
Analyze clustering, proximity, orientation, intervisibility, and other spatial relationships.

**Archaeology**
Create a 3D model of the excavation site to compare data and spatial relationships.

**Routing and Scheduling**
Optimize your field work force. Improve on-time delivery and services. Get routes and driving directions throughout the United States, Canada, and Europe.

**Managing Natural Resources**
GIS is instrumental as a communication tool between disparate groups of government and private businesses.

images from www.esri.com
...see http://www.esri.com/industries.html for applications in your area of interest.
CAS GE 365
Introduction to Geographical Information Systems

Instructor
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CAS 439C
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Teaching Fellow
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CAS 334
617 353 8846
zhao26@bu.edu
Office hours: Tuesday and Thursday 9:00-10:30

Class Meetings
Tuesday and Thursday 2:00-3:30 PM, CAS 327

Class Web Site
http://courseinfo.bu.edu/courses/07sprgcasge365_a1/

Objectives
The objectives of the course are to:
1. Introduce basic GIS and spatial analysis skills.
2. Provide opportunities to process, visualize, and analyze spatial data.
3. Emphasize the significance of spatial data, GIS, and spatial statistics to the study of a variety of problems.

Description
A Geographic Information Systems (GIS) is “a collection of computer hardware, software, and geographic data for capturing, storing, updating, manipulating, analyzing, and displaying all forms of geographically referenced information” (ESRI Press). GIS is employed by consultants, businesses, analysts, researchers and government in diverse areas such as geography, land use and transportation planning, environment, utilities, sociology, archeology, criminology, wildlife habitat management, health and human services, and environmental analysis. If you think you’ve never personally used GIS before, you certainly have experienced its power through many of the GIS applications such as maps in the media, interactive maps on the web, GoogleEarth, Mapquest (or other websites providing directions), auto navigation systems, and perhaps even Geocaching. This introductory course provides you with the essentials required for a beginning GIS practitioner and researcher. Topics covered include hardware and software components, methods of data capture and sources of data, nature and characteristics of spatial data and objects, data structures, elementary GIS operations, raster and vector GIS, and an overview of various applications using GIS. The course emphasizes hands on learning by spending over half of the in-class time working hands on with GIS and spatial data.
Readings

Most readings are assigned from the textbook for the course (available for purchase at the BU bookstore):


There will also be supplementary readings, which will either be downloadable from the web, handed out in class, or put on reserve.

Software/Lab

The software used for the course is ArcGIS 9, which is installed in the CAS 327 computer lab. Completion of assignments and the final project will require students to work independently in the computer lab outside of the class session.

In order to log onto the machines in 327, you need to link your accounts to Active Directory using the following link (a one-time operation):

http://www.bu.edu/computing/accounts/ad/cas

Requirements and Grading

25% Lab Exercises (Some individual and some group)
20% Midterm Exam – Tuesday March 6 in class
20% Final Project (Group, with a final presentation)
30% Final Exam – Monday May 7, 2:00-4:00
5% Class participation

The class participation includes (among the usual things) a brief presentation to the class. Each of you will need to find a partner in the class, select an exciting GIS application (e.g., found from the web or media) and give a 5 minute presentation to the class that describes the application area and how they are using GIS.

Attendance at all lectures and labs is mandatory. You are expected to be at class on time (particularly since presentations by your fellow students will start many of the lectures). Assignments are to be turned in at the beginning of class on the day they are due. On any individual lab assignments, you are encouraged to discuss the problem with your peers but you must produce and write-up work independently. Any deviation from any of these rules will result in a grade reduction.

Both the midterm and final exams will contain a written portion and an ArcGIS portion.

Students are reminded of their responsibility to know and understand the provisions of the Academic Conduct Code. Copies are available in CAS 105.
Topics to be covered (schedule follows)

Part 1: Introduction

1a. Introduction to GIS
   Introduction to GIS and spatial thinking.
   READING:  Chang Chapter 1
              NY Times (July 18, 2005) Marrying Maps to Data for a New Web Service

1b. Visualization & Data Exploration
   Spatial display of information and basic query operations. Introduction to ArcGIS
   READING:  Tufte Chapters 1 and 2
             Chang Chapters 10 and 11
   LAB:  Mapping Africa

Part 2: Data, Data, Data

2a. Data – Models
   Discuss the two primary data models: Vector (point, line, area) and Raster (grid cells).
   READING:  Chang Chapters 3 and 5

2b. Data – Sources and Editing
   Where do data come from? How can we import them into GIS?
   READING:  Chang Chapter 6, Chapter 8, and Chapter 17 (sections 1 and 2)
   LAB:  Serving Boston’s Transit Dependent Population

2c. Data – Coordinate Systems
   The world is round and the GIS display flat… thus, the importance of coordinate systems.
   READING:  Chang Chapter 2
   LAB:  Coordinate Systems

Part 3: Spatial Analysis

With spatial analysis, we’ll start doing calculations with the data, e.g. proximity analysis and buffers.

3a. Spatial Analysis – Vector
   READING:  Chang Chapter 12
   LAB:  Deforesting Alaska – or – Cholera outbreak

3b. Spatial Analysis – Raster
   READING:  Chang Chapter 13
   LAB:  Jamaican bobsled

3c. Spatial Analysis – Networks and Algorithms
   READING:  Chang Chapter 18
   LAB:  Optimizing deliveries
Part 4: Advanced Topics

4a. **Global Positioning System**  
**Guest Lecturer: Francesca Scire' Scappuzzo Seidel**  
The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of satellites placed into orbit by the US Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. Signals are transmitted from these satellites to GPS receivers to determine location, speed and direction. GPS has a wide range of applications including study of earthquakes, telecommunication networks, and auto navigation systems. In this module, you’ll learn how GPS works, various issues in using it, and get hands on application with GPS receivers.  
**READING:** TBA  
**LAB:** TBA

4b. **Introduction to Spatial Statistics**  
The purpose of these lectures is to give you a hint of the world of spatial statistics – a critical application area of GIS. Spatial statistics moves beyond observing where things are located towards investigating why particular spatial patterns exist, e.g. patterns in lung cancer, voting, owl nests, etc.  
**READING:** TBA  
**LAB:** No lab, although there will be in-class exercises.

4c. **The Group Project – GIS Applications to Health in Boston**  
**In collaboration with medical researchers at the BU medical campus.**  
The purpose of the final project is to give you a chance to put your knowledge to test and work creatively with GIS. You will work in small groups of 2 to 4 students, each group designing their own project objectives and carrying the project through to develop findings. On Thursday, April 12 you will submit a one page project proposal defining your team, your objectives, and your research plan. The final deliverable of the project will be in the form of a PowerPoint file and an oral presentation to the class summarizing your objectives, methods, and findings. The final projects will be presented in class on April 24, April 26 and May 1.  
For example projects from last year, see [http://people.bu.edu/joanw/classproj.html](http://people.bu.edu/joanw/classproj.html)  
**READING:** TBA
## Approximate Schedule

The schedule, topics, labs and readings are subject to change, in which case announcements will be made in class as appropriate.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>T Jan 16</td>
<td>1a. Intro to GIS</td>
</tr>
<tr>
<td>R Jan 18</td>
<td>1b. Visualization and Data Exploration</td>
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<tr>
<td>T Jan 23</td>
<td>1b. Visualization and Data Exploration</td>
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<td>R Jan 25</td>
<td>2a. Data - Models</td>
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<td>T Jan 30</td>
<td>2b. Data - Sources and Editing</td>
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<td>R Feb 1</td>
<td>2b. Data - Sources and Editing</td>
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<td>T Feb 6</td>
<td>2c. Data - Coordinate System</td>
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<td>R Feb 8</td>
<td>3a. Spatial Analysis - Vector</td>
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<tr>
<td>T Feb 13</td>
<td>3a. Spatial Analysis - Vector</td>
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<tr>
<td>R Feb 15</td>
<td>3b. Spatial Analysis - Raster</td>
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<tr>
<td>T Feb 20</td>
<td>NO CLASS (Monday Schedule)</td>
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<td>R Feb 22</td>
<td>3b. Spatial Analysis - Raster</td>
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<td>T Feb 27</td>
<td>3c. Spatial Analysis - Networks</td>
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<td>R Mar 1</td>
<td>3c. Spatial Analysis - Networks</td>
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<td>T Mar 6</td>
<td>MIDTERM EXAM</td>
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<td>R Mar 8</td>
<td>4c. Introduction to Group Project</td>
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<td>T Mar 13</td>
<td>NO CLASS (Spring Break)</td>
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<td>R Mar 15</td>
<td>NO CLASS (Spring Break)</td>
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<tr>
<td>T Mar 20</td>
<td>4a. Global Positioning System</td>
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<td>R Mar 22</td>
<td>4a. Global Positioning System</td>
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<td>T Mar 27</td>
<td>4a. Global Positioning System</td>
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<td>R Mar 29</td>
<td>4a. Global Positioning System</td>
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<td>T Apr 3</td>
<td>4c. Further discussion of group project</td>
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<td>R Apr 5</td>
<td>4c. Group project work time</td>
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<tr>
<td>T Apr 10</td>
<td>4b. Introduction to Spatial Statistics</td>
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<td>R Apr 12</td>
<td>4c. Group project work time</td>
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<td>T Apr 17</td>
<td>4b. Introduction to Spatial Statistics</td>
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<td>R Apr 19</td>
<td>4c. Group project work time</td>
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<td>T Apr 24</td>
<td>4c. Project presentations</td>
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<tr>
<td>R Apr 26</td>
<td>4c. Project presentations</td>
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<td>T May 1</td>
<td>4c. Project presentations</td>
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<tr>
<td>R May 3</td>
<td>Course wrap up</td>
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<tr>
<td>M May 7</td>
<td>FINAL EXAM, Monday May 7 2:00-4:00 PM</td>
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