**GEOG 5150/6150: Spatial Data Design for GIS – Fall 2014**

OSH 238  
M,W 8:05-9:25am

**Instructor:**  
Richard Medina  
OSH 270H  
richard.medina@geog.utah.edu  
(801)585-6245  
Office Hours: W 9:30-11:00am and by appointment

**Lab Section:**  
Instructor – Brent Lloyd  
Meeting location and time – OSH 277, M 9:40-11:35

**Texts:**  
**Required**  

**Optional**  

**Course Overview:**  
This course takes you beyond the world of GIS to the bigger world of spatial databases. Spatial database management systems (SDBMS) are database management systems designed to store, manage and query data on spatial objects and their attributes. Understanding SDBMS is not only essential for advanced GIS, but also to support a much wider range of geographic information services such as Google Maps and location based apps.

**Learning Objectives:**  
After successful completion of this course, you should:

1. Understand the relational database design process and be able to design and normalize relational data;
2. Understand spatial object definition and construction to be an intelligent consumer of these objects and methods;
3. Understand how to bring #1 and #2 together and be able to design a spatial database;
4. Be able to write and execute traditional and spatial queries using SQL;
5. Understand the basics of physical data storage and access, and their implications for database performance tuning;
6. Understanding the basics of systems and database architectures and distributed databases;
7. Understand the basics of temporal, spatio-temporal and moving objects database management.

**Grading:**  
The components of the final grade are as follows:  
Examinations: 50%  
Lab Assignments: 50%

**Exams:**  
There will be approximately 4 exams, none of which are comprehensive. The final exam is scheduled on Tuesday, Dec. 16, 2014, 8:00 - 10:00am
Policies:
1) Individual extra credit will not be assigned.
2) An "incomplete" will be given only in extreme cases when conditions beyond the student's control require an extended period of absence. Even in this case, at least 80% of the course requirements must be completed.
3) Examinations must be taken during scheduled times announced in class. If you have a legitimate excuse (such as medical, family illness or unavoidable work conflicts), you must contact the instructor before the examination. If you do not contact the instructor before the examination you will not be able to make up the examination unless the circumstances were extreme and contacting the instructor was difficult.
4) The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). http://disability.utah.edu/. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.
5) Academic misconduct will not be tolerated. Penalties may include failure of an assignment, the entire course, and/or the filing of formal charges with appropriate university authorities. Academic misconduct includes, but is not limited to, cheating, misrepresenting one’s work, and plagiarism:
   • Cheating involves the unauthorized possession or use of information in an academic exercise, including unauthorized communication with another person during an academic exercise such as an examination.
   • Misrepresenting one’s work includes, but is not limited to, representing material prepared by another as one’s own work or submitting the same work in more than one course without prior permission of all instructors.
   • Plagiarism means the intentional unacknowledged use or incorporation of any other person’s work in one’s own work offered for academic consideration or public presentation.

Course Webtools
This course has an online component using the CANVAS e-learning environment. It is available through the Campus Information System at www.utah.edu. You are responsible for all announcements, additional reading assignments and other material posted at the GEOG 5150/6150 site, so be sure to check it frequently. I will also be posting PDFs of the slides I use in the lectures, as well as links to helpful and interesting websites.

Course Outline:
Topic Readings
1. Introduction
   Introduction to databases WD 1-43
   Introduction to spatial databases SC 1-20
   Spatial object-relational databases Zeiler 1-19
2. Object-relational databases and spatial objects
   Relational databases WD 43-45
   Database development WD 55-71
   Object-orientation and spatial objects WD 71-82
   Designing spatial object-relational databases
3. Relational algebra and SQL
   Overview of relational algebra and SQL WD 221-229
   Examples SC 52-82
4. Structures and access methods
   General database structures and access WD 221-229
From one to two dimensions WD 229-234
Raster structures WD 234-240
Point structures WD 240-248
Linear objects WD 248-250
Object collections WD 250-255
Spherical data structures WD 255-258

5. Architectures
   Hybrid, integrated and composable architectures WD 259-262
   Syntactic and semantic heterogeneity WD 262-266
   Distributed systems WD 266-278
   Location-aware computing WD 278-291

6. Time
   Introduction WD 359-367
   Temporal databases and versioning WD 367-371
   Spatio-temporal databases WD 371-382
   Mobile objects databases TBD

**Holidays:**
Labor Day – Monday, September 1st
Fall Break – Sun-Sun, October 12-19th
Thanksgiving Break – Thursday-Friday, November 27-28th
Contents and Objectives

There are thirteen laboratory sessions designed to apply theories and techniques in spatial database design learned during the lectures. Students will be asked to complete a lab assignment after each lecture and must work individually unless that particular lab calls for collaboration. Students should have sufficient proficiency in GIS to follow lab lectures and complete assignments. After this semester, each student should be able to design a database, implement the design in ArcGIS, and manage the created database, including the use of Microsoft SQL Server.

Evaluation

- **10 Lab Assignments (100pts in total)**: each will be assigned a grade based on how much work is required to finish the task. Please refer to the individual assignment descriptions for details.

- The due date for each assignment will be specified in the syllabus. Assignments will be due by the beginning of each lab. One assignment of choice can be turned in late, but only if the lab instructor is notified before the original due date passes. Ten percent of the total possible points will be taken off of the assignment for each day that it is late. Outside of the one allotted late assignment, exercises turned in after the due date will not be accepted unless a reasonable excuse is provided before the due date.

- No hand-written assignments will be accepted; materials to be turned into the instructor must be typed. **NO emailed assignment** will be accepted, unless a reasonable excuse is given.

Policies

- No extra credit will be offered.

- Students are highly encouraged to attend the labs and lectures. If you miss either, it’s your responsibility to catch up with the class. Attendance will be recorded in the lab section and may influence your lab grade in situations where you are on the cusp between letter grades. Please note that it will not hurt your grade and is not used explicitly to raise or lower it.

- Students are encouraged to help each other in their work. However, final products turned into the instructor must display evidence of individual initiative and creativity.
• Academic Misconduct will not be tolerated. Penalties may include failure of an assignment, the entire course, and/or the filing of formal charges with appropriate university authorities. Academic misconduct includes, but is not limited to, cheating, misrepresenting one’s work, and plagiarism:
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**Resources**

**CSBS:** Lab materials will be uploaded to the network drive provided by CSBS Computing. Any problem accessing your file on the server you can contact CSBS Find at: [https://support.csbs.utah.edu/](https://support.csbs.utah.edu/), OSH 100, or call 801-585-8985.

**Lab Schedule**

The lab schedule is tentative and is subject to change in the event of extenuating circumstances. The schedule is located on the next page.

**Other Notes**

CSBS and the University do not provide storage for your data, so you will need to have some sort of personal storage device, such as a flash drive or external hard drive, where you can keep your work. You may find that you have a small amount of space on the N: drive, but it will not be enough to hold all of the course files and assignments.
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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Unit</th>
<th>Topics</th>
<th>Assignment due</th>
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<tr>
<td>02</td>
<td>09 – 01</td>
<td>1</td>
<td><em>No Lab</em></td>
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<tr>
<td>03</td>
<td>09 – 08</td>
<td>1</td>
<td>Exploring the Geodatabase</td>
<td>09-15</td>
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<td>04</td>
<td>09 – 15</td>
<td>2</td>
<td>Database Design 1: E-R Diagram</td>
<td>09-22</td>
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<td>05</td>
<td>09 – 22</td>
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<td>Database Design 2: Relational Model</td>
<td>09-29</td>
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<tr>
<td>06</td>
<td>09 – 29</td>
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<td>Database Design 3: Object-Oriented Model</td>
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<td>07</td>
<td>10 – 06</td>
<td>3</td>
<td>Create Geodatabase &amp; Load Data</td>
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<td>08</td>
<td>10-13</td>
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<td>Fall Break</td>
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<td>08</td>
<td>10 – 20</td>
<td>3</td>
<td>Relational Algebra &amp; SQL: Examples</td>
<td>10-27</td>
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<td>09</td>
<td>10 – 27</td>
<td>4</td>
<td>Improve Database Performance (Create Index etc.)</td>
<td>11-03</td>
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<td>10</td>
<td>11 – 03</td>
<td>4</td>
<td>Multi-User Database 1: Create Users and Versions</td>
<td>11-10</td>
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<td>11</td>
<td>11 – 10</td>
<td>4</td>
<td>Multi-User Database 2: Deal with Multi-User Editing</td>
<td>11-17</td>
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<td>12</td>
<td>11 – 17</td>
<td>4</td>
<td>Database Management (Back Ups, Log Files, etc...)</td>
<td>11-24</td>
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<td>13</td>
<td>11 – 24</td>
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<td>Work on Final Project</td>
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