Geography 574 Geospatial Database Design and Development

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Lectures

9:30AM - 10:45AM, Tuesday/Thursday, 360 Science Hall

Labs

Thursday 11:00-12:55 and 13:45-15:45, 380 Science Hall

Course Overview

Designing databases provides a foundation for GIS functions and web applications. Students will investigate techniques used for designing databases in non-spatial environments and explore "spatial" considerations while developing a spatial database for GIS problems. The course will cover the basic concepts, techniques and methodologies for designing and implementing a spatial database. The main content of this course will include:

- Fundamental database concepts, benefits of using databases, functions of database management systems;
- Data modeling and database design: Entity-Relation diagrams, relational model, object-oriented database design, object-relational database, georelational model;
- Geospatial database creation, query and manipulation through SQL;
- Usages of modern geospatial databases products (e.g., PostgreSQL/PostGIS and ArcSDE);
- Usages of NoSQL database (e.g., MongoDB/Hive) for big spatial data management;
- Spatial big data mining;
- Other topics related to spatial database design: spatial data sharing, warehouse, legal issues;

Course Goals

Upon the completion of the course, students are able to:

- Develop a strong conceptual understanding of database design and implementation in GIS;
- Use open source database software (Postgresql/PostGIS) to create and manage spatial databases;
- Use Structured Query Language (SQL) to create and manipulate databases;
- Learn how to perform spatial query and operations over a spatial database;
- Design and develop a spatial database and program to solve specific geographic information problems.

Course Requirements

At least one introductory GIS course (Geog 377).

Recommended Textbook

S. Shekhar and S. Chawla, Spatial databases: a tour. Prentice Hall, 2003.
A. Silberschatz, H Korth and S. Sudarshan, Database System Concepts, 6/e. McGraw Hill. 2011. (*Not required*)

Additional readings might be assigned throughout the semester and be available on the Learn@UW course website.

Evaluation

Your grade in this course is based on two exams, ten labs, several ad-hoc quizzes, and final project. The points assigned to each component are as follows:

Items	Percentage	Date
Exam#1	15%	03/11
Quizzes (6, dropping the lowest)	5%	ad-hoc
Lab (7)	35%	throughout
Exam#2	15%	04/29
Final project	30%	5/17 (noon)

Quizzes: Quizzes will be administered during any class period - immediately after a lecture, at the beginning or end of a class, etc. **Make-up quizzes will not be given at any circumstance, no exceptions.** However, the lowest quiz scores will be dropped.

Lab: You will complete seven lab assignments throughout the semester. Most labs will consist of exercises and small projects using open sources to practice and reinforce your understanding about database concepts. Plagiarism is not tolerated. As with other evaluated items, any offense results in a zero for the lab assignment and disclosure of the impropriety to the Department and University. Assignment must be submitted to ***Learn@UW dropbox*** prior to the start of class on the day it is due. **Late labs will be marked down 10% a day;** submission of an assignment the day it is due, but after the deadline (e.g., following your lab that day), counts as one day late**.** Technical complications (e.g., disk errors, printing problems) are not reason for extension; be sure to back up copies of all of your work and version meticulously, as forgetting to save and back up your database is the easiest way to lose your work. Requests for grade changes must be submitted in writing (via email) within ***24 hours*** of receiving your feedback.

Exams: Exams include a combination of multiple choices, True/False, and short answer questions, with an emphasis on the latter. A review is provided one or two days prior to the exam. The exams are not cumulative. While group studying is encouraged, cheating during the exam is not tolerated and results in a zero for the exam and disclosure of the impropriety to the Department and University. Exam must be taken at the scheduled time and date. **Make-up exams will not be given unless prior arrangements have been made with the instructor.** Make-up exams require a doctor's note or, in the event of planned travel, must be rescheduled ***4 weeks*** in advance. Make-up exams are in an essay format, rather than primarily short answer.

Term project: A project that utilizes spatial database and programming technologies to solve problems is required. **One page project proposal and a final project report (~ 2000 words) are required by the due day.** Each project will be carried out individually. Students will be required to present your project to the class at the end of the semester. Guidelines of the term project presentation and report will be released during the semester.

Grading criteria

90 - 100%	A
87 - 89.9%	AB
83 - 86.99%	B
80 - 82.99%	BC
75 - 79.99%	C
70 - 74.99%	DC
60 - 69.99%	D
< 60%	F

Scholastic dishonesty

Academic honesty and integrity are expected. All work, including labs, quizzes and exams, must be completed independently. It is expected that the work submitted by a student reflects his or her original ideas and responses. Submissions that reflect substantially similar work among more than one student, or similar to certain online sources, will be regarded as an act of scholastic dishonesty. As a result, credits will be deducted. Scholarly dishonesty includes: "cheating on an examination; collaborating with others in work to be presented, contrary to the stated rules of the course; submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another; submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas, etc." Please refer to the "Student Academic Misconduct Policy & Procedures" document produced by Student Advocacy & Judicial Affairs division of the Offices of the Dean of Students for further information.

Tentative Schedule

Week	Date	Topics/Lab	Readings	Assignment
1	01/20	Course intro; Database fundamentals	Learn@UW/Ch1	
	01/22	Database fundamentals *cont*		
	01/22	Lab#1 PostgreSQL Tutorial I: GUI Admin tool (pgAdmin III)		
2	01/27	DB design 1: Entity-Relation (ER) model	Learn@UW/Ch2	
	01/29	DB design 1: ER diagrams		
	01/29	Lab#2 Design an ER diagram using pgModeller		Lab#1 due
3	02/03	DB design 2: Relational DB concept	Learn@UW/Ch2	
	02/05	DB design 2: Principles to build a relational DB (online lecture, no meeting)		
	02/5	Lab#2		
4	02/10	Relational operations and algebra	Learn@UW/Ch3	
	02/12	Structured Query Language (SQL)		
	02/12	Lab#3 PostgreSQL Tutorial II: Command line		Lab#2 due
5	02/17	SQL *cont*	Learn@UW/Ch3	
	02/19	Spatial database and design: Concept		
	02/17	Lab#4 Data retrieval and manipulation using SQL		Lab#3 due
6	02/24	Spatial database and design: Principles and steps	Learn@UW	
	02/26	Modeling our world		
	02/24 , 25	Lab#4		
7	03/03	Geodatabase	Learn@UW/Ch3	
	03/05	Spatial query I: spatial joints, spatial aggregates		
	03/05	Lab#5 ESRI Geodatabase tutorial: Design and implement a spatial DB		Lab#4 due
8	03/10	**Exam#1 (75 minutes)**		
	03/12	Go over Exam#1		
	03/12	Lab#5		
9	03/17	Spatial query II: nearest neighbor, reverse nearest neighbor, network queries	Ch4/5	
	03/19	Spatial storage		
	03/19	Lab #6 PostGIS Tutorial I: spatial query		Lab#5 due
10	03/25	Spatial indexing	Ch5/Learn@UW	
	03/27	NoSQL database I: Introduction (MongoDB/Hive)		
	03/27	Lab #6		
11	03/31	Spring break, no class		
12	04/07	NoSQL database II: Data retrieval and manipulation; Demo		
	04/09	JDBC for database access; demo		
	04/09	Lab #7 PostGIS Tutorial II: spatial indexing and optimization		Lab#6 due
13	04/14	Spatial data mining I	Ch7	
	04/16	Spatial data mining II		
	04/16	Lab #7		
14	04/21	EXAM #2: 75 - minute final (non-cumulative)		
	04/23	AAG, no class		
	04/23	Final project consultation workshop		Lab#7 due
15	04/28	Go over Exam #2 Project presentation format and misc.		
	04/30	Spatial DB issues, trends, management and administration		
	04/30	Final project consultation workshop/ Qunying meet with students		
16	05/06	Final Project Presentations and Class Discussion		
	05/08	Final Project Presentations and Class Discussion		
	05/08	Final project consultation workshop		
17	5/17	Final project report/video submission		Projects due

*This is a tentative agenda, check up-to-date version through Learn@UW