Geography 574 Spatial Database

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Labs

- Tuesday 3:45 – 5:45 pm & Thur 1:15 – 3:15 pm, 380 Science Hall

Basic Course Information:

- This is a **hybrid course** with **online lectures** and **in-person labs**.
- The course can be accessed at any time during the offering period. The course materials are available through Canvas (UW NetID login required).
- Course materials will be posted on Canvas weekly, or more frequently if necessary.
- When writing an E-mail to us, please follow the format "**G574-LastName Question**" in the title, just in case the email may be deleted as junk mail.
- Response time: We will respond to email and the Canvas discussion board once a day during the week. While I will do my best to stay on top of class related emails, I anticipate that some messages will slip under the radar due to time constraints and the large number of students I teach. If you have sent me an email but have not heard back from me within 48 hours, please send me a follow-up email.

Course Overview

Well-designed spatial databases provide 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;
- Structured Query Language (SQL) for database creation, query and manipulation;
- Spatial database design and implementation, and spatial query;
- Use of modern spatial databases products (e.g., PostgreSQL/PostGIS and ESRI Geodatabase);

- Use of NoSQL databases (e.g., MongoDB/Hive) for big spatial data management;
- Other topics related to spatial database optimization, e.g., spatial indexing.

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 relational databases;
- Use SQL to create and manipulate databases;
- Learn how to perform spatial query and operations over a spatial database;
- Understand and use NoSQL database for big data management;
- Design and develop a spatial database and program to solve specific geographic information problems.

Course Requirements

At least one introductory GIS course (Geog 377 or Geog170).

Recommended Textbook

- S. Shekhar and S. Chawla, Spatial databases: a tour. Prentice Hall, 2003.
- 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
Quizzes (3)	15%	throughout
Lab (7)	55%	throughout
Final project	30%	5/17 (noon)

Quizzes: There will be three text-based quizzes, usually consisting of multiple-choice questions and short answers, based on the lecture material. The quiz period closes at midnight one week after the day of opening. Once you begin a quiz, you will have 30 minutes to complete it.

> **NOTE:** Students may use course materials, books and internet resources to answer quiz questions. However, they may not consult with other individuals either in person by other means (such as the internet).

Lab Assignments: You will complete seven lab assignments throughout the semester. Most labs will consist of exercises and small projects using PostgreSQL/PostGIS 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. Labs are due **by midnight one day before the next lab session**. **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.

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 or demonstration video are required by the due date.** Each project may be carried out individually if the project is part of the thesis work or in a group of two (**Graduate**) or three **(Undergradue) students** at most. Graduate student group must have at least three research questions can be answered by manipulating spatial DB (e.g., spatial queries), and/or creating maps to visualize the query results through ArcGIS, and undergraduate group only need to propose two questions. To present and share your projects with your peers, students can submit a project report or record a video of database design and system implementation.

Items	Undergraduate/Individual	Graduate
Team member	< 3	< 2
Relations in the DB	> 2	> 3
Research questions	>2	> 3
In-class report	Poster	Presentation
Final report	~1500 words	~ 2000 words

* If one graduate student participates in a group, this group will be considered as "Graduate" category.

Grading criteria

Undergraduate	Graduate	Grade
90 - 100%	92 - 100%	A
86 - 89.9%	89 - 91.9%	AB
82 - 85.9%	85- 88.9%	B
78 - 81.9%	80 - 84.9%	BC
70 - 77.9%	75 - 79.9%	C
60 - 69.9%	60 - 74.9%	D
< 60%	< 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

*This is a tentative agenda, check up-to-date version through Canvas

Module	Week	Date	Topics	Labs	Assignments
Module 1: Relational DB fundamentals	1	9/6	Lecture1: DB Fundamentals I (DB concept and elements)	Tutorial: PostgreSQL Download and Installation	Install PostgreSQL/ PostGIS on your computer
	2	9/11	Lecture2: DB Fundamentals II (DB architecture, design process etc.)	Lab1 PostgreSQL Tutorial I: GUI Admin tool (pgAdmin III)	
	3	9/18	Lecture3: database design – Entity relation model	Lab2 PostgreSQL Tutorial II: Command line	Lab1 Due
	4	9/25	Lecture4: Relational Model	Lab3 Design an ER diagram using pgModeller	Lab2 Due
	5	10/2	Lecture5: Structured Query Language	Lab4 Data retrieval and manipulation using SQL	Lab3 Due Quiz1 Due (10/2); Project group formed by 10/9
Module 2: Spatial DB and Query	6	10/9	Lecture6: Introduction to Spatial DB		
	7	10/16	Lecture7: Building a Spatial DB-final	Lab5 ESRI Geodatabase design	Lab4 Due
	8	10/23	Lecture8: Spatial DB Design Documentation	Lab6 Geodatabase Implementation	Lab5 Due; Project proposal Due 10/23
	9	10/30	Lecture9: Spatial Query-PostGIS; **In-person meeting for project discussion**	Lab7 PostGIS Tutorial I: spatial query	Lab6 Due; Quiz2 Due (10/30);
	10	11/6			
Module 3: Advanced Concepts	11	11/13	Lecture10: Index	Lab8 PostGIS Tutorial II: spatial indexing and optimization	Lab7 Due
	12	11/20	Lecture11: NoSQL	Course exercise | NoSQL: MongoDB	Lab8 Due
Module 4: Project	13	11/27	Final project consultation		Quiz 3 Due (11/27)
	14	12/4			
	15	12/11			
	16	12/18	Final project report or video submission		Projects due