South Dakota State University

GEOG 477/577 - S01, 3 credits
Spatial Databases
Course Syllabus (Spring 2020)

Course Instructor:	Dapeng Li, Ph.D., GISP
Meeting Time:	Tue. 3:00 - 4:50 pm
Meeting Location:	Wecota Hall, Room 014 (the GIS Lab)
Office Hours:	Tue. & Wed. 1:00 - 3:00 pm (or by appointment)
Office:	Wecota Hall 115D
Phone:	(605) 688-4620
Email:	dapeng.li@sdstate.edu (primary contact)

Lab Section

SECTION	LAB INSTRUCTOR	DAYS	LOCATION	MEETING TIME
477/577L S01	Thomas White	Thursday	Wecota Hall 014	3:00 PM – 4:50 PM

Lab Instructor

Name	E-mail	Phone
Thomas White	thomas.white@jacks.sdstate.edu	605-688-4511

Course Description

This course is an advanced course in the field of Geographic Information Systems (GIS) and covers spatial database design and management. Specifically, this course covers the following aspects: basic concepts and principles of relational and spatial databases, relational/spatial database design, entity-relationship (ER) diagram, structured query language (SQL), spatial query, data/user management, spatial indexing, etc. Meanwhile, this course also aims to help students develop some practical skills in relational and spatial databases via the use of relevant database software (e.g., PostgreSQL/PostGIS, MySQL, and MS SQL Server) in the lab section.

Course Prerequisites

GEOG 372 Introduction to GIS or equivalent course/experience.

Instructional Methods

Lecture, discussion, demonstrations, lab assignments, final project, presentation, quizzes/exams.

Course Schedule

Date	Topic	Readings	Lab
1/14	Course Overview	Syllabus	Lab Overview: B Ch. 1, 2, 3
1/21	Introduction to Spatial Databases	C Ch. 1, O Ch. 1	Lab 1: B Ch. 4, 5, 6, O Ch. 4.2, 5.3
1/28	Data Modeling & Introduction to SQL	C Ch. 2, Ch. 7	Lab 2: B Ch. 7, 8, O Ch. 1
2/4	Advanced SQL and Spatial Data Types	C Ch. 8, O Ch. 2	Lab 3: B Ch. 9, 10, 18, 19, O Ch. 2
2/11	Coordinate Systems	O Ch. 3	Lab 4: B Ch. 16, 17, O Ch. 3
2/18	The Relational Database Model	C Ch. 3, 4	Lab 5: TBD
2/25	Advanced Data Modeling	C Ch. 5, 6	Project Time (MS Visio)
3/3	Spatial Database Design	C Ch. 9; TBA	Lab 6
3/10	No Class (Spring Break)	N/A	No Lab
3/17	Spatial Query	O Ch. 9	Lab 7: B Ch. 11, 12, 24, O Ch. 9
3/22	Final Project Proposal Due in D2L by Midnight		
3/24	Spatial Data Processing	O Ch. 6, 11	Lab 8: B Ch. 13, 14, 19, 20, O Ch. 6, 11
3/31	TBD		Lab 9: TBD
4/7	No Class (AAG Conference)	TBA	No Lab
4/14	TBD		Project time
4/21	Project Advising & Support		Project time
4/28	Final Project Oral Presentation	Final project Due on 4/27 @ 5 pm	
5/7	Final Exam	Thurday, 4:00 – 6:00 pm @ Wecota Hall 014	

Abbr.: Coronel & Morris (C), Obe & Hsu (O), Boundless (B).

This schedule is subject to change. Students will be notified of any changes.

Course Requirements

Required Text

Coronel, C., & Morris, S. (2018). Database systems: design, implementation, & management (13th edition). Cengage Learning.
Obe, R. O., & Hsu, L. S. (2015). *PostGIS in action* (2nd edition). Manning Publications Co.
Boundless. *Introduction to PostGIS*. (free online at https://postgis.net/workshops/postgis-intro/).

Note: We will use the Cengage Mindtap platform for the Coronel & Morris book. This platform includes the ebook and many other resources. The fee will be automatically included in your tuition. Students will need to buy the Obe & Hsu book by themselves.

Optional Readings

Corti, P., Kraft, T. J., Mather, S. V., & Park, B. (2014). *PostGIS Cookbook*. Packt Publishing Ltd.
Elmasri, R., & Navathe, S. B. (2015). *Fundamentals of database systems* (7th Edition). Pearson.

Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). *Geographic information science and systems* (4th edition). John Wiley & Sons (ISBN: 978-1118676950)

Marquez, A. (2015). *PostGIS Essentials*. Packt Publishing Ltd.

Manolopoulos, Y., Papadopoulos, A. N., & Vassilakopoulos, M. G. (Eds.). (2005). *Spatial databases: technologies, techniques and trends*. IGI Global.

Nasser, H. (2014). *Learning ArcGIS Geodatabases*. Packt Publishing Ltd.

Shekhar, S., & Chawla, S. (2002). *Spatial databases: A tour*. Pearson.

Urbano, F., & Cagnacci, F. (Eds.). (2014). *Spatial Database for GPS Wildlife Tracking Data: A Practical Guide to Creating a Data Management System with PostgreSQL/PostGIS and R*. Springer.

Worboys, M. F., & Duckham, M. (2004). *GIS: A computing perspective*. CRC press.

Yeung, A. K., & Hall, G. B. (2007). *Spatial database systems: Design, implementation and project management*. Springer.

Other readings may also be assigned and will be provided by the instructor accordingly.

Lab Materials

Students will also need (at least) an 8 GB Flash Drive to store their lab and final project materials. All the data on the lab computers will be automatically wiped out when the computers are rebooted. SAVE YOUR FILES!!!

Attendance Policy

Attendance and full participation in classes is expected of all students. Attendance will be checked periodically. The class participation credit is given based on class attendance and/or in-class/take-home exercises. If you do not show up, 5 points will be deducted each time.

Make-up Policy

If a student misses an exam, points can only be made up if the student has an excused absence. To be considered an excused absence, the student must contact the instructor with a legitimate excuse prior to the day of the exam.

Classroom Policies
- All cell phones need to be turned off during the class/lab.
- No recording (photos, audio, etc.) without permission.
- Using computers/smartphones to surf the internet or work on other tasks is not allowed.
- If a laptop is used to take lecture notes, please sit in the back of the classroom.

Important Dates:
- Januarys 13, Monday   First day of class
- January 22, Wednesday   Last day to drop or add and adjust final fees

- January 23, Thursday   "W" grade begins
- March 9-13, Monday – Friday   Spring Break (No Class)
- March 16, Monday   First Half Spring Term ends
- April 6, Monday   Last day to drop a course
- April 10-April 12, Friday – Sunday   Easter Recess
- May 4-May 8**,   Monday – Friday Final exams
- May 13, Wednesday   Grades due by midnight

Overall Course Goals

Upon completion of this course, students will be able to:

1. Understand and recall the fundamental concepts and principles of spatial databases.
2. Understand the procedures in spatial database design, implementation, and management.
3. Understand relevant queries and operations in spatial databases.
4. Apply the knowledge learned in the class to design a spatial database for a specific application.
5. Be able to use PostgreSQL/PostGIS to implement a spatial database and manage spatial data for a specific application.

Student Learning Outcomes

Knowledge Outcomes

Students will master the basic concepts and principles in spatial database and learn how to design and implement a spatial database for a specific real-world application.

Skills Outcomes

Students will **develop specific skills and competencies in spatial databases** and **learn to use spatial databases in real-world applications**. Students will use the methods learned in the class to complete a final project. Other skill outcomes include written communication, interpersonal communication, professional presentation, and planning and organization.

Grade Evaluation

Evaluation Components	Points (each)	Points	Percent Value
Participation	TBD	100	10%
Lab Assignments (8)	50	400	40%
Quiz	TBD	100	10%
Final Exam	100	100	10%
Final Presentation	100	100	10%
Final Paper	200	200	20%
Total		1000	100%

Course Grade Scale

Grade	Final weighted points
A	90-100
B	80-89
C	70-79
D	60-69
F	< 60

Weekly Lab Exercises: In the labs, we will use the open source PostgreSQL/PostGIS software and/or other database software (e.g., MySQL, MS SQL Server) to reinforce the concepts covered in the lectures. We have one lab each week. The students will do some demo first and then proceed to work on the assignment each week. Although class time has been allocated for lab tutorials and assignments, additional work may also be necessary. Lab assignments must be submitted electronically through the Dropbox on D2L. The TA will grade the assignments and post the grades in D2L. Please check the lab syllabus for more details on lab policies.

Quiz: Students will take a few quizzes online during the semester. The quizzes will be graded and counted toward the final grade (10% in total). It is strongly encouraged that the students check their email/D2L periodically to get the updates from the instructor.

Exam: This course has a final exam. The exam will include true/false questions, multiple choice questions, matching questions, short answer questions, and comprehensive essay questions. The questions come from the key points covered in the lecture, and a study guide will be given before the exam.

Final Project: The students are expected to use what they have learned in the class to accomplish a final project. The project is about designing and implementing a spatial database for a special GIS application. The project must be original work. Thus, the students are STRONGLY encouraged to discuss with the instructor regarding project ideas as early as possible. Undergraduate students can work on the project by themselves or in groups of two. Graduate students need to work on the project on their own.

Specifically, the final project should include the following components:

1. A project proposal that includes introduction, background information, data sources, spatial database design, and expected results. (within 5 pages (including figures), word count: 800~1,500 (undergraduate), 1,000~1,500 (graduate))
2. A PowerPoint presentation (about 15 minutes) that summarizes the key steps in designing and implementing the spatial database.
3. A final report that consists of title, introduction, spatial data compilation, database design, database implementation, results, discussion, and conclusion (10 ~ 25 pages (double-spaced); word count: 1,500~2,500 (undergraduate), 2,000~3,000 (graduate)).

More details on each component will be provided during the semester. Please refer to the course calendar for specific due dates.

Class Participation: Student participation in class discussion and interaction is strongly encouraged. Attendance will be checked in every lecture.

Extra Credits: There will be some extra assignments during the semester, and extra credits will be given to those who accomplish the assignments on time. Extra credits will be added to the participation section in D2L.

Lab Section & Final Project

The lab section is designed to help students gain hands-on experience in spatial database design and management. There will be a number of weekly assignments for the students to enhance their skills in spatial databases. Upon the completion of these specially designed labs, the students will work on a final project to demonstrate their competency in using spatial databases in real-world applications. Please note:

- Attendance to all of the labs is required, and lab attendance will be graded.
- The weekly lab assignments need to be completed and submitted on time; penalty will be applied for the late submissions (Please refer to the lab syllabus for more details).
- NEVER try to skip a lab or leave one unfinished before starting another one - the technical skills required for a latter lab are often based on previous ones.
- NEVER be too shy to ask. Feel free to ask me or your lab instructor if you have any questions.
- Memorize all the commands, the procedures, and the solutions you used to solve each of the problems or generate each of the maps.

ADA Statement:

Any student who feels s/he may need an accommodation based on the impact of a disability should contact Nancy Hartenhoff-Crooks (or successor) Coordinator of Disability Services (605-688-4504 or Fax, 605-688-4987) to privately discuss your specific needs. The Office of Disability Services is located in room 065 at the University Student Union.

Freedom in Learning Statement:

Students are responsible for learning the content of any course of study in which they are enrolled. Under Board of Regents and University policy, student academic performance shall be evaluated solely on an academic basis and students should be free to take reasoned exception to the data or views offered in any courses of study. Students who believe that an academic evaluation is unrelated to academic standards but is related instead to judgment of their personal opinion or conduct should first contact the instructor of the course. If the student remains unsatisfied, the student may contact the Department Head, Dean, or both, of the college which offers the class to initiate a review of the evaluation.

TurnItIn

All written assignments in D2L will be automatically submitted to TurnItIn for plagiarism detection. Students should make sure that their assignments are their original work before they submit them in D2L. Students should also check the similarity score of their submitted documents to ensure that their assignments pass the plagiarism test.

Student Academic Integrity and Appeals:

The university has a clear expectation for academic integrity and does not tolerate academic dishonesty. University Policy 2:4 sets forth the definitions of academic dishonesty, which includes but is not limited to, cheating, plagiarism, fabrication, facilitating academic dishonesty, misrepresentation, and other forms of dishonesty relating to academics. The policy and its procedures also set forth how charges of academic dishonesty are handled at the University. Academic Dishonesty is strictly proscribed and if found may result in student discipline up to and including dismissal from the University.