

GEOG 5150/6150: Spatial Data Design for GIS – Fall 2019

GC 1570

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

Instructor:

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Office Hours: M 9:30am-11:30am, W 9:30-11:00am, or by appointment

Lab Section:

Instructor – Tim Edgar

Meeting location and time – GC 1855, M 9:40am-11:35am

Texts:

Required: Worboys and Duckham. (2004) GIS: A Computing Perspective (2nd ed). CRC Press.

Optional: Shekhar, S. and Chawla, S. (2003) Spatial Databases: A Tour. Pearson.
Zeiler, M. (2010) Modeling Our World: The ESRI Guide.

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 3 exams, none of which are comprehensive.

Tentative schedule of exams:

Exam 1 – Wednesday, September 18th

Exam 2 – Wednesday, October 23rd

Exam 3 – Wednesday, December 6th

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.

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
TBD Topics	
NoSQL	
Hadoop (Spatial Hadoop)	

Last Day of Class: Thursday, December 6th

Holidays:

Labor Day – Monday, September 2nd

Fall Break – Sun-Sun, October 6th-13th

Thanksgiving Break – Thursday-Sunday, November 28th – December 1st

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.

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 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.

Safety & Wellness

Your safety is our top priority. In an emergency, dial 911 or seek a nearby emergency phone (throughout campus). Report any crimes or suspicious people to 801-585-COPS; this number will get you to a dispatch officer at the University of Utah Department of Public Safety (DPS; dps.utah.edu). If at any time, you would like to be escorted by a security officer to or from areas on campus, DPS will help — just give a call.

The University of Utah seeks to provide a safe and healthy experience for students, employees, and others who make use of campus facilities. In support of this goal, the University has established confidential resources and support services to assist students who may have been affected by harassment, abusive relationships, or sexual misconduct. A detailed listing of University Resources for campus safety can be found at <https://registrar.utah.edu/handbook/campussafety.php>

Your well-being is key to your personal safety. If you are in crisis, call 801-587-3000; help is close.

The university has additional excellent resources to promote emotional and physical wellness, including the Counseling Center (<https://counselingcenter.utah.edu>), the Wellness Center (<https://wellness.utah.edu>), and the Women's Resource Center (<https://womenscenter.utah.edu>). Counselors and advocates in these centers can help guide you to other resources to address a range of issues, including substance abuse and addiction.

The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

Undocumented Student Support. Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. **Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence.** The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. **To learn more, please contact the Dream Center at 801.213.3697 or visit dream.utah.edu.**

- ***Frequently Asked Questions:***

As the Dream Center has become more established, we are receiving recurring questions. We have answered these questions and included them on a new page on our website: [Frequently Asked Questions](#). Please visit our page and if you have additional questions, updates, or recommendations you would like to propose, let us know. We welcome feedback and suggestions.

- ***Outreach and Information Materials:***

With the support from the Office for Equity & Diversity, we have developed and included new resources materials on our page: [UndocuAllies](#). These new outreach and information materials include a new brochure available in [English](#) and [Spanish](#), and the Utah State Court Self-Help Center: Detention Emergency Resources. *We will be regularly revising these resources, so please make sure to visit our website for updates.*