SSCI 582 – Spatial Databases, Course Syllabus Spring 2014

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Office Hours: (tentative) Monday – Friday by appointment
Available asynchronously via email. Also available for synchronous chats via Skype or Adobe Connect most days and times *by prior arrangement* via email.

Post your course-related questions on the Blackboard discussion boards so that we can share the knowledge among students in the most efficient way.

Course Scope and Purpose

Geographic information systems (GIS) are fundamentally information systems. Although GIS provide specialist facilities for storing and manipulating spatial data, much of the functionality offered by GIS is shared with conventional database software. Indeed, most GI systems have at their core a conventional database management system (DBMS) around which spatial functionality has been wrapped. Understanding database theory is *the* foundation to understanding the technical aspects of GIS.

This course stresses the need to understand the theories that underpin the design of databases. However, the core objective of the course is a practical one – upon completion students should understand the fundamental principles in the design and implementation of well-conceived geodatabases. Consequently, this course has a strong practical element. SSCI 582 includes a small set of hands-on practical exercises in which you will undertake designing, implementing and querying some simple databases, both non-spatial and spatial.

This course will provide students with the practical skills to design, implement, and interrogate relational databases together with the requisite knowledge to critically assess both current database models and developments of those models for geospatial data. Themes covered include:

- **Basic Database System Concepts –** What is an information system? What are databases? What do they do? Why are they necessary – generally and specifically for GIS?.
- **Database Models –** Relational models and object-oriented models
- **Data modeling and Database Design –** Methods and techniques for database design and modeling, including: the entity-relationship model, unified modeling language, and database normalization
- **Other Topics –** Structured Query Language (SQL), Simple Features for SQL (SFSQL), spatial databases on the cloud, spatial data standards, metadata, spatial indexes, data warehouses and data mining, and legal issues.

Prerequisites

Please review the following courses on Lynda.com (http://www.usc.edu/its/lynda/):

- Windows 7 Essential Training
- Foundations of Programming: Databases
- SQL Essential Training (optional but highly recommended)

How to Excel in This Course

- Schedule your work ahead of time
- Do NOT do your assignments two days before the deadline – You might have the experience that you wrote a paper in a couple hours and got an A. This is not the way you can survive in this course. You will benefit the most from this course if you split the work into several days (especially for the technical assignments) instead of working straight for 10 hours trying to get it done.
- Ask me for help if you have questions

Learning Outcomes

On completion of this course, students should be able to:

- Design well formed database models, using appropriate design techniques, and be able to implement such designs using relational database software
- Use SQL and SFSQL to establish and interrogate databases
- Use ArcGIS and cloud-based spatial databases to create and populate geodatabases
- Critically assess the limitations of conventional database structures as a means of storing spatial data
- Critically assess current advances in database design for geographical applications

Course Structure

The course will be presented via Blackboard. There will be a number of assigned readings, short papers, hands-on tutorials, discussion postings, and a final project. The course will generally unfold on a weekly or bi-weekly basis through a posted Assignment document that provides instructions on readings and work to be completed within the given time period. When possible, assignments will be posted in advance, but usually they will be posted on or just before the relevant Monday.

Textbooks

The main theoretical concepts will be provided through a directed reading of:

- *Spatial Database Systems: Design, Implementation and Project Management* by Yeung and Hall, 2007, Springer. DOI: 10.1007/1-4020-5392-4_1
- Good News! You do not need to purchase this book - it is available to all USC students through the library e-books system as downloadable PDFs. To get to the site, you must

first log into the USC library and then you can search for the DOI indicated above. This will take you to the book's page on the SpringerLink site.

For each chapter of this book assigned, USC faculty has produced some additional Reading Notes to help you work through this material.

A highly recommended, optional text is:

- *Modeling our World: The ESRI Guide to Geodatabase Concepts,* Second Edition, by Michael Zeiler, 2010, ESRI Press, Redlands CA

This book provides substantial guidance that will be helpful as you implement and work with geodatabases in ArcGIS.

Assessment

There will be four kinds of assessments:

- Short Papers (6 for a total of 30%): these papers are intended to give you the opportunity to apply and discuss key themes in the readings. Each of these assignments will be one of several types including short critiques of assigned readings, discussions of how the week's concepts apply to a specific practical problem, summary of some related library and/or web research, etc.

- Tutorials (4 for a total of 32%): a set of four hands-on exercises will give students practical experience with the SQL, SFSQL, and the design and implementation of a geodatabase. At the completion of each tutorial, you will submit a report.

- Discussion Postings (4 for a total of 8%): In addition to unstructured discussions about course materials, through these assignments, you will have opportunities to share information with other students in the class. For some of these, you will post a brief summary and discussion about a relevant article from an academic journal that you have found during this course. Other students will be invited to comment on your observations. These will be graded on a credit/no credit scale.

- Final Project (30%): to integrate learning of all the material covered in the course, for the final project, students will design and document a geodatabase for an individually chosen project that is the context of discussion in several of the written assignments. In addition to submitting a fully annotated and illustrated document and a final report, students will make an on-line public presentation via Adobe Connect and publish a video to discusses their database design.

SSCI 582 requires significant effort on homework assignments. Any assignments submitted after the due date and time will be penalized as indicated on the assignment handout. Assignments over 1 week late will receive no grade with no exceptions.

I am a stickler for good writing and merciless about plagiarism. You must write your assignments in your own words, sentences, and paragraphs, and these must be free of typographical and grammatical errors (as MS Word will help you catch and correct). To Repeat: You must **not** copy other people's work (including web pages, books, and other students' work) to accomplish your assignments. For some assignments, it is tempting to just quote articles or

webpages but please do not do it. I insist that you to read, process, and then write your own answers. I will not grade your assignment if it contains more than three (3) errors of diction (per MS Word) or if your originality score is less than 50% (per TurnItIn on the Blackboard). Refer to the "Statement on Academic Integrity" section and check the website: http://plagiarism.org/

Student Learning Resources

The primary resources are the textbook and the associated reading notes. These materials are supplemented by a mixture of readings from academic journals, professional reports and authoritative websites.

For the tutorials and the final project, we will use SQL Server, CartoDB, and ArcGIS 10 plus some other tools. These will be accessible over the Internet via the GIST Server. Instructions on accessing the Server will be provided at the appropriate time in the course.

Requirements

Technology – There are several technology requirements:

- ArcGIS and most other software used in this course are provided on-line via the GIST Server.
- Every student must have a computer with a fast Internet connection (DSL at a minimum). Since we now serve the key software from the Server, you can use either a Mac or a PC.
- Every student MUST have a functional webcam for use whenever a presentation or meeting is scheduled.

Communications: This is a distance-learning course, so most of our interactions will be asynchronous (not at the same time). Assignments are to be submitted to me via Blackboard.

For each weekly or biweekly assignment, I will post an announcement on our course Blackboard site pointed to the associated readings and assignments. Additionally, I will send via email through Blackboard any notices that are time sensitive. Please be sure that you read as soon as possible all email sent from Blackboard or from me. Also double check to be sure that mail sent from both the USC blackboard accounts and my private domain (yaoyichi@gmail.com) does not go into your junk mail!

While I am usually on-line and will probably respond to emails and posts on discussion board from students very quickly, I will endeavor to respond to all emails and posts within 24 hours of receipt, aiming for no more than 36 hours delay. In the rare case when I expect to be off-line for more than 24 hours, I will post an announcement on the Blackboard site. **Please post course related questions on the Blackboard discussion board so that everyone can see my answer or help answer your question.**

*Your responsibility***:** it is each student's responsibility to stay informed about what is going on in our course. In addition to email about time-sensitive topics, any important announcements will be posted on the Announcement page in the Blackboard. Be sure to check these each time you log onto the Blackboard.

Workload: this is a four credit, one semester course. Students should expect to spend 10-12 hours per week completing the work in this course. Do not start your assignments on the last day.

Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to an instructor as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

Important Administrative Dates[1]

1/13: Spring semester classes begin
1/20: Martin Luther King Day, university holiday
1/31: Last day to register and add classes
1/31: Last day to drop a class without a mark of "W" and receive a 100% refund
2/17: Presidents' Day, university holiday
3/17-22: Spring recess
4/11: Last day to drop a class with a mark of W
5/2: Spring semester classes end
5/3-6: Study days
5/14: Final Examinations end
5/16: Commencement

[1] http://www.usc.edu/academics/classes/term_20141/calendar.html

Tentative Course Schedule

Week	Starts	Due.	Theme/Book Chapter	Assignment Topic
1	13-Jan		Introduction, Ch1. Current Status Spatial Information Tech.	D1 - Introduce yourself P1 - eLibrary research
2	20-Jan†	D1 P1	Ch2. Concepts of Database Systems Ch3. Database Models and Data Modeling	P2 - Semantics & Ontology
3	27-Jan	P2	Database design and SQL (for T1)	P3 - Database design, T1 – SQL Server
4	3-Feb	P3		
5	10-Feb	T1	Ch4. Spatial Data & Spatial Database Systems	D2 – Fields as objects
6	17-Feb	D2	Object-Orientation (for T2)	T2 - Esri Geodatabases
7	24-Feb	T2		P4 - Spatial data structures
8	3-Mar	P4	Spatial Databases on the Cloud (for T3)	T3 - CartoDB
9	10-Mar	T3	DB Design Document (for T4) – Part1	T4 - DB design document
	17-Mar		- *Spring Recess* -	
10	24-Mar		DB Design Document (for T4) – Part2	
11	31-Mar	T4	Ch5. Spatial Data Standards and Metadata	P5 - ESRI data models
12	7-Apr	P5	Ch6. Spatial Data Sharing, Data Warehousing	D3 - on Ch5 and 6
13	14-Apr	D3	Ch7. Legal Issues	P6 – on Ch5, 6, and 7
14	21-Apr	P6	Ch11. Spatial Data Mining	D4 – Spatial Data Mining
15	28-Apr	D4	Ch12. Trends of Spatial Database Systems	Classes end: Fri 2-May
END	5-May‡ thru 12-May		Term Project Report & Presentation	Commencement: Fri 16-May

D = Discussion, P = Paper, T = Tutorial

† Jan 20th is a University holiday.

‡ May 3-6th listed as Study Days (no class work) and May 7-14th reserved for Final Exams
Term Projects are presented during Final Exams week; Report and Slide deck due May 14th EOD.