SSCI 582 (35696), Spatial Databases

Units: 4
Term: Fall 2015
Location: Online, via Blackboard

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Course Description

Geographic information systems (GIS) are fundamentally information systems, typically built on database management technologies. Although GIS offer specialist facilities for storing and manipulating spatial data, much of the functionality provided by GIS is shared with conventional database software and its ubiquitous Structured Query Language (SQL). Thus, understanding database principles is the foundation for mastering the technical aspects of GIS.

This course provides a high-level tour of the theoretical underpinnings of databases containing both spatial and tabular data, as these are integrated in GIS. However, the core objective of the course is a practical one: to understand the fundamental principles in the design and implementation of well-conceived spatial databases, especially Esri geodatabases, and be able to manipulate them both inside and outside of GIS.

The Final Project involves building a geodatabase for a practical GIS application. This project has two main components: 1) a formal report (~2,000 words, excluding figures, tables, references, and map) that documents your project professionally – this must include a graphical geodatabase design, tabular data dictionary, sample data and queries; and 2) a succinct (~15-minutes) oral presentation of the project, as at a professional conference.

Learning Objectives

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

- Discuss the complexity of the geographic world and techniques for modeling it in a computer.
- Explain the strengths and limitations of various database and non-database structures for spatial data, particularly those supported by Esri ArcGIS.
- Use SQL fragments and/or statements as appropriate to interrogate (geo)databases to accomplish data loading, maintenance, map production, and analysis.
- Define a geographical realm of interest, model that realm diagrammatically and narratively, implement the model in a geodatabase.

Prerequisite(s): None
Co-Requisite (s): None
Concurrent Enrollment: At most one other class
Recommended Preparation: SSCI 581

Course Structure

This online course can be pursued entirely asynchronously; however, it also offers synchronous Web-based seminars, which are optional but strongly recommended, to discuss the assigned readings and various topics that arise from them. Students are encouraged to bring questions and problems to these seminars, to be explored in that congenial setting. The aim is to encourage deep-learning by active participation.

Technological Proficiency and Hardware/Software Required

We have several technologies that will facilitate our course work and our interactions, despite our dispersed locations. These include:

Blackboard – All course materials and correspondence will be posted on the course Blackboard site. As a registered student, you will find this course will show up in your available classes no later than 12:00 noon, PT on the first day of classes. It is here that the day-to-day flow of the course will be recorded.

Discussion boards – On the Blackboard site, we will post a number of discussion threads related to various course topics. These threads are very important in terms of providing support to each other while working on class exercises to share hints and helpful tips, as you would do in a classroom or lab setting. Your instructor will check the discussion threads periodically and offer occasional comments. Please send your course instructor an email directly if you have a question or concern that requires immediate attention.

Live meetings and presentations – We will use browser-based services called Adobe Connect and BlueJeans to create synchronous, interactive sessions. With voice and webcam capabilities, these services can be used to share presentations and even our desktops between two or more people.

Individual meetings – We will also use Blue Jeans or Adobe Connect for one-on-one meetings.

GIST server and tech support – This course will utilize the SSI GIST Server which is a virtual desktop. You access the GIST Server using VMware. If you are unable to connect to the server or experience any type of technical issues, send an email using your USC account to GIST Tech Support at gistsupport@dornsife.usc.edu, making sure to copy (cc) me on the email. GIST Tech Support is available Mondays through Fridays, from 10 a.m. to 5 p.m. PT.

Every student should be proficient with the MS Office suite (Excel, PowerPoint, and Word), all of which are available on the GIST Server. Documents in other software formats will not be accepted. In addition, students' personal computer systems must meet several technology requirements:

- An up-to-date computer with a fast Internet connection.
- A functional Web camera together with a microphone or headset for live sessions.
- A modern Web browser (Firefox, IE or Chrome is recommended) to run ArcGIS which is provided online via the GIST Server; you do not need to install ArcGIS on your own computer.

Required Readings and Supplementary Materials

There are two required texts for this course, available from the USC Bookstore or online outlets such as Amazon. Note also that the first text is available *free* through the USC Libraries as an e-Book.

- Yeung, Albert K. W. and G. Brent Hall. 2007. *Spatial Database Systems: Design, Implementation and Project Management*. The GeoJournal Library, 87. Dordrecht: Springer, 553 pp. DOI: 10.1007/1-4020-5392-4_1
- Zeiler, Michael. 2010. *Modeling Our World: The Esri Guide to Geodatabase Concecpts*, 2nd ed. Esri Press, 308 pp. ISBN 1589482786

For each chapter of Young & Hall text (aka "Y&H") the GIST faculty has produced reading notes to help you work through the material.

There are several supplementary readings, also supplied by the instructor on Blackboard.

- Couclelis, Helen. 1992. "People manipulate objects (but cultivate fields): Beyond the raster-vector debate in GIS", in *Theroies and Methods of Spatio-Temporal Reasoning in Geographic Space*, edited by Andrew U. Frank, Irene Campari, and Ubaldo Formentini, 65-77. London: Springer.

- Guptill, Stephen C. 1999. "Metadata and data catalogs", in *Geographical Information Systems: Principles, Techniques, Management, and Applications*, 2nd ed., edited by Paul A. Longley, Michael F. Goodchild, David J. Maguire, and David W. Rhind, 677-692. Hoboken, NJ: Wiley.

- Hunter, Gary J. 2002. "Understanding semantics and ontologies: They're quite simple, really - If you know what I mean." *Transactions in GIS* 6 (2): 83-87.

- Longley, Paul A., Michael F. Goodchild, David J. Maguire, and David W. Rhind. 2005. *Geographical Information Systems and Science,* 2nd ed., Ch.3, 63-83. Hoboken, NJ: Wiley.

- Peuquet, Donna J. 1999. "Time in GIS and geographical databases", in *Geographical Information Systems: Principles, Techniques, Management, and Applications*, 2nd ed., edited by Paul A. Longley, Michael F. Goodchild, David J. Maguire, and David W. Rhind, 91-103. Hoboken, NJ: Wiley.

- Wilson, John P., and John C. Gallant. 2000. "Digital Terrrain Analysis", in *Terrain Analysis: Principles and Applications*, edited by John P. Wilson and John C. Gallant, 1-26. Hoboken, NJ: Wiley.

In addition, five Esri Web Campus (http://training.esri.com) courses are supplied with this course.

- Getting Started with Geodatabase
- Getting Started with Geodatabase Topology
- Working with Geodatabase Domains and Subtypes
- Getting Started with Linear Referencing
- Transforming Data using Extract, Transform, and Load (ETL) Processes

Description and Assessment of Assignments

Performance in this course is determined on the basis of several assessment tools. Students update their student resume, prepare a set of research assignments and review blogs on database theory, and complete a set of practical Esri Web trainings during the first ten weeks of class; thus prepared, they undertake the Final Project during the final weeks of the semester.

Student Resume (2%): Students must update their Student Resume during the first two weeks of term.

Theory – Reading Assignments (32%): Students complete reading and writing assignments and structured blogs or discussions throughout the class. These assignments cover essential theoretical material and perspectives, intended to help integrate practical aspects of Esri geodatabases (below).

Practice - Trainings and Tutorial Assignments (43%): Students also work four hands-on tutorials with databases and ArcGIS on the GIST Server, and concurrently complete five Esri Virtua Campus modules on geodatabases, during the first ten weeks of the class.

Final Project (20%): During the last half of term, students work in small teams (2-5 max) on projects determined in consultation with the instructor, to develop and populate a practical geodatabase design with sample data. Team projects are emphasized to share the intellectual discovery process that inevitably accompanies geodatabase development, as well as to accomplish more substantial work in the time available, i.e. collecting the spatial and non-spatial data, importing those data into a suitably designed geodatabase, producing and interpreting maps, etc.

Class Participation (3%): Students are expected to actively engage with their classmates in this course. From the outset, students do peer-review and co-writing assignments.

During the last weeks of the class, students will be mostly doing work on Final Projects; the instructor may also participate. During this period, students maintain a Journal or Wiki on Blackboard discussing their progress and obstacles during this period.

Grading Breakdown

Assignments	Number of Assignments	Points Per Assignment	% of Grade
Student Resume	1	2	2
Reading Assignments	4	5	20
Blogs & Discussions	3	4	12
Esri trainings (Certificates)	5	3	15
Tutorial Assignments	4	7	28
Class Participation	-		3
Final Project, components			
- Final Project Proposal	1	2	2
- GeoDB design	1	5	5
- GeoDB implementation	1	5	5
- GeoDB report, poster	1	5	5
- Oral presentation	1	3	3
Totals	**22**	**-**	**100**

And finally, it is important to note from the outset that: (1) you are expected to attend and participate in pre-arranged online meetings and to complete and upload all assignments before the deadlines detailed in the Course Schedule; (2) late postings and assignments will be docked one grade and no grade will be given for postings or assignments turned in more than one week late; and (3) no written work will be accepted for grading after 5:00 p.m. PT on the last day of classes (i.e.3rd December, 2015).

Assignment Submission Policy

Unless otherwise notes, assignments will be submitted for grading via Blackboard using the due dates specified in the Course Schedule below.

Additional Policies

Communications – This is a distance learning course, so most of our interactions will be asynchronous (not at the same time). All materials to be handed in will be submitted via the Blackboard Assessment link. I will also create multiple Blackboard discussion forums throughout the semester that we will use for the aforementioned assignments and so we can discuss issues and comments on the course assignments, exercises and projects as the need arises.

In addition, I will send via e-mail through Blackboard any notices that are time sensitive. Please be sure that you read as soon as possible all e-mail sent from Blackboard or from me. Check now to make sure that mail sent from both the USC blackboard accounts and my email jswift@usc.edu (does not go into your junk mail! While I am usually online and will probably respond to e-mails from students relatively quickly, I will endeavor to respond to all e-mail within 24 hours of receipt, aiming for no more than 48 hours delay. In the rare case when I expect to be offline for more than 72 hours, I will post an announcement on the Blackboard site.

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

<u>Workload</u> – This is a four credit, one semester course. Students should expect to spend 12-15 hours per week completing the work in this course.

Course Schedule

	Topics/Daily Activities	Readings and <u>Assignments</u>	Deliverables Due
Week 1 8/24	**Getting Started**	Longley&al (2005)-Ch.3 Student Resume (SR) Reading Assignment 1: What is a Lake?	Fri 8/28, Student Resume
Week 2 8/31	**Technological Context;** **Desktop R-DBMS**	Y&H-Ch.1 Zeiler, Ch.1 Tutorial1 (T1): MS Access	Mon 8/31, Reading Assignment 1
Week 3 9/8 (Tues)	**Fields as Objects**	Y&H-Ch.2, to p.34 Couclelis (1992) Blog1 (B1): Fields as Objects	Tues 9/8, Tutorial 1
Week 4 9/14	**Semantics and Ontology;** **Server R-DBMS**	Hunter (2002) Tutorial2 (T2)	Tues 9/8, Blog 1
Week 5 9/21	**Representing Terrain**	Y&H-Ch.2, from p.35 Wilson&Gallant (2000) Blog2 (B2): Terrain	Mon 9/21, Tutorial 2
Week 6 9/28	**Data Modeling**	Y&H-Ch.3, to p.79 Hecker 5A Reading Assignment 2: E-R Diagramming	Mon 9/28, Blog 2
Week 7 10/5	**Esri Geodatabases (I)** **Final Project – kick-off**	Esri Certificate 1 (C1): GeoDB Tutorial3 (T3): Great Lakes in 3 GeoDBs	Mon 10/5, Reading Assignment 2 Fri 10/9, Certificate 1
Week 8 10/12	**Database Mechanics** **Final Project** – week 1	Y&H-Ch.3, from p.79 Hecker 5B Reading Assignment 3: Normalization	Mon 10/12, Tutorial 3
Week 9 10/19	**Esri Geodatabases (II)** **Final Project** – week 2	Esri Certificates 2 (C2): Topology & (C3): Domains Tutorial4 (T4): Endorheic Lakes of the World	Mon 10/19, Reading Assignment 3 Fri 10/23, Certificates 2 & 3

Week 10 10/26	**Representing TIme** **Final Project** – week 3	Peuquet (1999) Esri Cert4 (C4): Linear Referencing Final Project Proposal	Mon 10/26, Tutorial 4 Fri 10/30, Certificate 4
Week 11 11/2	**Legacy Geodata** **Final Project** – week 4	Y&H-Ch.4 Esri Cert5 (C5): Transforming Data w/ETL Reading Assignment 4	Mon 11/2, Final Project Proposal Fri 11/6, Certificate 5
Week 12 11/9	**Documentation** **Final Project** – week 5	Y&H-Ch.5 Guptill (1999) Blog3 (B3): Metadata & Standards	Mon 11/9, Reading Assignment 4
Week 13 11/16	**Working on** **Final Project** – week 6	Final Project	Mon 11/16, Blog 3
Week 14 11/23	**Finishing up** **Final Project**	Thanksgiving break (25-28)	Mon 11/23, Tue 11/24 Final Project Presentations
Week 15 11/30	**Finishing up** **Final Project**	All work must be submitted by 5:00 p.m. PT on Fri 3rd Dec, the last day of classes	Fri 12/4 Final Project Reports, Posters

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/b/11-00-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, harassment, and sexual assault are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The *Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support,

and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. The *Office of Disability Services and Programs* https://dsp.usc.edu/ provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Resources for Online Students

Our course Blackboard site provides links to several different resources that you may need. In particular, you will be making frequent use of the online USC Library that is available to all registered students through the link http://www.usc.edu/libraries. Once on this site, you can find additional resources for distance students under the link "Library Services". Many other resources and links to key people you may need to contact are also listed on the Blackboard site under Other Resources and Contacts.