SSCI 582 – Spatial Databases
Course Syllabus – Fall Semester 2014

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Office Hours: I am generally available afternoons (Pacific Time) via Blackboard and email. I generally hold open recitation sessions on Wednesday and Thursday evenings via Adobe Connect. I am also available for private chats on AdobeConnect or Bluejeans *by prior arrangement* via email, and *in case of emergency* on mobile. Just get in touch!

I encourage you to post your course-related questions on the Blackboard discussion boards so that we can share the knowledge among students in the most efficient way. I subscribe to the discussion forums on Blackboard and try to review the forums nightly. **My priority is to read/respond to emails first, then forums.**

Course Scope and Purpose

Geographic information systems (GIS) are fundamentally information systems, typically built on database management technologies. Although GIS provide specialist facilities for storing and manipulating spatial data, much of the functionality offered 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. During the course, we cover five major topics:

Geographical Complexity – We will first re-discuss the complexity of the geographical world, conceptually and experientially, and the modern GIS emphasis on semantics and ontology as approaches to capturing this complexity.

Data Modeling Techniques – Through the first nine weeks, in interactive recitation sessions led by the instructor, supported by Web-hosted drawing tools, we will practice formal techniques for data modeling, as classically applied in database technologies.

Spatial Data Structures – Concurrently in the first nine weeks, we will re-visit the evolution, benefits and constraints of spatial data structures used in GIS to date: digital drawing tools, rasters and vectors, shapefiles, coverages, and databases (with spatial support).

Esri Geodatabases – Beginning in Week 5, students will work individually on Esri Virtual Campus modules to develop skills in applying conceptual analysis, data modeling, and mapping of the geographical world, specifically using Esri geodatabases.

Advanced Topics – In the last four weeks, again in interactive recitation sessions, in part led by students, we will deal with advanced geodatabase topics: archiving, concurrency control and versioning, geolibraries, metadata, schema evolution, special data (LiDAR, TIN, netCDF).

Learning Outcomes

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

- Appreciate the complexity of the geographic world and techniques for modeling it.
- Understand 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 facilitate 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 visualized in a map.

Course Formats

This is a graduate level course, so you should expect it to be both academically robust and intellectually challenging. As graduate students you are expected to actively engage with the material you are learning and to explore the heady cauldron of ideas, opinion, and analysis that describe our collective effort to thoroughly interrogate the subject at hand. Learning arises from active engagement with the knowledge found in our reading materials and with one another. As in any graduate class, the instructor's role is that of a guide who keeps you on this path of discovery and you will find that you will learn much from your fellow classmates. The challenge for us is to replicate such an academic experience within the milieu of "online learning".

All course materials will be organized through Blackboard. The main theoretical concepts will be provided through course notes and assigned readings. Reading assignments will give students an opportunity to internalize and apply the concepts and theory learned from readings. Some assignments require student interaction; all will benefit from it.

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

Blackboard – All course materials and correspondence will be posted on the course Blackboard site; it is here that the day-to-day flow of the course will be recorded. As a registered student, you will gain access to this course no later than 12:00 noon, PT on the first day of classes.

Discussion boards – On the Blackboard site, I will post discussion threads related to various course topics. These threads help you provide support to each other while working through the course materials, as you would do in a classroom setting. I will check the discussion threads periodically and may offer occasional comments. Please send me an email if you have a question or concern that requires immediate attention.

Live meetings and presentations – We will use a browser-based service called Adobe Connect™ to create synchronous, interactive tele-sessions. With its integrated audio/video and screen-sharing capabilities, Adobe Connect facilitates presentations among up to 25 people. For groups of four or more, we generally use a companion telephone for improved audio.

Individual meetings – While Adobe Connect can be used for one-on-one tele-sessions, we also use free, video and voice-over-IP chat technologies, such as Bluejeans (www.bluejeans.com) and Skype (www.skype.com) for individual meetings.

GIST server and tech support – This course utilizes the SSI GIST Server, which provides a virtual PC desktop, for your access to all required software. You can access the GIST Server at https://gistonline.usc.edu. If you are unable to connect or experience any type of technical issues, send an email to GIST Tech Support at gistsupport@dornsife.usc.edu, copying me. GIST Tech Support is available Monday through Friday, 9:00 a.m.-5:00 p.m., PT.

Assessments

Student grades in this course will be determined on the basis of several assessment tools:

Resume Assignment – 1 for a total of 2 points. The GIST Program requires all current students to post and maintain a public resume, short biography, and recent photo on our shared Student Community Blackboard site. With your permission, your photo and resume will be also posted to the SSI website and your resume will be included in the GIST Resume Book, which is compiled annually. Our Web presence and the Resume Book are used to promote GIST and, more importantly, your skills, experience, and professional aspirations.

Reading Assignments (Papers) – 5 for a total of 30 points. You are expected to complete five multi-part reading assignments and associated digests, termed "papers", in this course. These reading assignments cover essential theoretical material and perspectives, intended to help you integrate practical aspects of Esri geodatabases (below).

Discussion Forums (Blogs) – 3 for a total of 12 points. You are expected to post in three topical discussion forums, structured as "blogs", which appear in the first half the course; in these, your own experience, research, and/or opinion are sought. In addition to you own posts, you are expected to review at least two posts made by classmates in each forum.

Topic Sessions (Recitations) – 4 to 12 for a total of 8 points. During the first nine weeks of the course, I usually offer *optional* asynchronous (Blackboard) discussion boards or interactive (AdobeConnect) tele-sessions on basic topics. These mechanisms can be helpful to those of you who seek a more interactive learning style with other students or with me. Materials from the Papers and Blogs may also emerge in these Recitations, to facilitate their completion. In weeks 10-13 of this course, your attendance at Recitations is *expected* – contributing ≤ 2 points per session towards final grades – as you will be presenting on advanced topics along with me.

Esri Virtual Campus Modules – 3 for a total of 6 points. You are required to demonstrate satisfactory completion of three Esri Virtual Campus modules on geodatabases, specifically by submitting the course completion certificates, which include the scores received for an Esri-authored quiz. A fourth, highly advantageous Esri module, Learning ArcGIS Desktop, is also available to those of you who want it, on a non-credit basis.

Geodata Tutorials – 4 for a total of 30 points. During the first nine weeks of the class, you will be working hands-on with three geodata tutorials using ArcGIS Desktop on the GIST Server. Your practical understanding of database, and particularly Esri geodatabase, topics is primarily built through these tutorials. Blogs and Recitations will provide you additional help with the tutorials, which are detailed and in different ways either challenging or tedious, depending on your background, experience, and point of view.

Final Project – 1 (with 2 components) for a total of 12 points. The final project will be your opportunity to integrate all that you have learned in the course by developing a prototype geodatabase with sample data and a supporting map display for one of several predefined topics, or, with my approval, a topic of your own choice. Paired-projects are encouraged to share the intellectual discovery process that inevitably accompanies geodatabase development, as well as to accomplish more substantial work in the time available (~4 weeks), i.e. collecting the appropriate spatial and non-spatial data, importing those data into a suitably designed Esri geodatabase, producing and interpreting maps, etc. Some final projects in this course evolve into, or help shape, thesis proposals, too.

If your final project topic is self-chosen, you must provide me abstract (~250 words) by week 9; and I must approve your topic.

The final project work itself comprises two components: (1) a formal report (≤2,500 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, for my grading; and (2) a succinct (~15-minutes) oral presentation of your project (4 points), as at a conference, again for fellow students and me.

Careful planning and a serious, consistent commitment will be required for you to successfully navigate the various deliverables in this and other GIST courses.

Be aware from the outset that: (1) 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 (2) no written work will be accepted for grading after 5:00 p.m. PT on the last day of classes.

The table below summarizes the SSCI 582 course assignments and their point distribution:

Assignments	Number	Points Per Assignment	Total Points
Resume assignment	1	2	2
Reading assignments	5	6	30
Discussion forums	3	4	12
Topic sessions (optional)	4 - 12	2 (weeks 10+)	8
Esri VC modules	3	2	6
Geodata tutorials	4	8	30
Final project, components			
Abstract, self-chosen	1	(option)	0
Formal report	1	8	8
Oral presentation	1	4	4
Totals	**23+**	**-**	**100**

Grades in this and other GIST courses use the standard USC grading criteria, as follows:

A	≥ 93 points	B-	80-82 points	D+	67-69 points
A-	90-92 points	C+	77-79 points	D	63-66 points
B+	87-89 points	C	73-76 points	D-	60-62 points
B	83-86 points	C-	70-72 points	F	< 60 points

Finally, 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). 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 document obviously contains non-original writing that is not referenced, or if it contains an excess of writing other than your own (in my judgment). Refer to the "Statement on Academic Integrity" section and check the website: http://plagiarism.org/

Requirements

Technology – Every student 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 tele-sessions.
- A modern Web browser (Firefox recommended) to run ArcGIS, which is provided online via the GIST Server; you do *not* need to install ArcGIS on your own computer.

Textbooks – There is one required text for this course, available from the USC Bookstore or online outlets such as Amazon. Please note that the Yeung & Hall text (referred to as "Y&H") is available through the USC Libraries as an e-Book. For each chapter of this text, the GIST faculty has produced some Reading Notes to help you work through this material.

Yeung, Albert K. W. and G. Brent Hall. 2007. *Spatial Database Systems: Design, Implementation and Project Management*. The GeoJournal Library, 87. Springer, 553 pp. DOI: 10.1007/1-4020-5392-4_1

Readings – Additional readings, listed in the order they will be posted to Blackboard

1. Longley, P. A., M. F. Goodchild, D. J. Maguire, and D. W. Rhind. 2005. *Geographical Information Systems and Science,* 2nd ed.; Ch.3. Wiley.
2. Zeiler, M. 1999. *Modeling Our World: The Esri Guide to Database Design* [1st ed.]; Ch.1. Redlands, CA: Esri Press.
3. Couclelis, H. 1992. People manipulate objects (but cultivate fields): Beyond the raster-vector debate in GIS. In *Theories and Methods of Spatio-Temporal Reasoning in Geographic Space,* ed. A. U. Frank, I. Campari, and U. Formentini, 65-77. Springer.
4. Hunter, G. J. 2002. Understanding semantics and ontologies: They're quite simple, really – If you know what I mean. *Transactions in GIS,* 6(2): 83-87.
5. Winter, S. 2002. Ontology: Buzzword or paradigm shift in GI Science. *International Journal*

of Geographic Information Science, 15(7): 587-590.

6. Mark, D. M. and A. G. Turk. 2003. Landscape categories in Yindjibarndi: Ontology, environment, and language. In *Spatial Information Theory*: *Foundations of Geographic Information Science,* ed. W. Kuhn, M. Worboys, and S. Timpf, 28-45. LNCS 2825. Springer.
7. Peuquet, D. J. 1999. Time in GIS and geographical databases. In *Geographical Information Systems: Principles and Applications*, 2nd ed., ed. D. J. Maguire, M. F. Goodchild, D. W. Rhind, and P. A. Longley, 91-103. Longman.
8. Strassberg, G. and D. R. Maidment. 2004. Arc Hydro Groundwater data model. In *Geographic Information Systems in Water Resources III*, ed. K. J. Lanfear and D. R. Maidment, 17-19. Middleburg, VA: American Water Resources Association.
9. Stonebraker, M., with D. Moore. 1996. *Object-Relational DBMSs: The Next Great Wave*; Ch.1. Morgan-Kaufman.
10. Goodchild, M. F. 2000. Communicating geographic information in a digital age. *Annals of the Association of American Geographers,* 90(2): 344–355.

Web Modules – There are four Esri Virtual Campus training modules supplied with this course, all to be covered in the first 10 weeks. The fourth module is particularly extensive, of value to both neophytes with ArcGIS Desktop, and to GIS professionals as an update/refresher

1. Getting Started with Geodatabase [for version 10.2.x]
2. Getting Started with Geodatabase Topology [for version 10.2.x]
3. Working with Geodatabase Domains and Subtypes [for version 10.2.x]
4. Learning ArcGIS Desktop (for ArcGIS 10); *Optional*, on request.

Communications – This is an online-learning course, so most of our interactions will be asynchronous (not at the same time). It is *your* responsibility to stay informed about the course.

I will post on Blackboard Announcements and/or send via Blackboard email any notices that are time sensitive. Check the Announcements each time you log onto Blackboard, and read as soon as possible all email sent from Blackboard or by me personally. Check to be sure, too, that no such email goes into your junk folder.

While I am usually online and will probably respond to emails from students relatively quickly, I will endeavor to respond to all email 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.

All materials to be graded will be submitted via Blackboard, either in the discussion forums or by direct upload. If the forum or upload link is not present, your submission is late; contact me to make alternate arrangements for submission.

Workload – This is a four credit, one semester course. Students should expect to spend 10-15 hours per week completing the work in this course.

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 from 8:30 a.m.to 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, while the recommended sanctions can be found at: http://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/.

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

8/25:	Fall semester classes begin
9/1:	Labor Day, university holiday
9/12:	Last day to drop a class without a mark of "W" and receive a 100% refund (no partial refund after this date); and last day to register and add classes
10/24:	Deadline to submit signed Approval to Submit form to the Graduate School
11/1:	Deadline to upload thesis or dissertation manuscript
11/14:	Last day to drop a class with a mark of "W"
11/26-29:	Thanksgiving recess, university holiday
12/5:	Fall semester ends

Tentative Schedule

#Week #	Week Begins	Theme	Relevant Readings	Assignments Due on Days Indicated			
			Y&H Text Article #s	Paper or Blog (Tue)	Recit'n (Wed/Thu)	DBMS /GIS (Thu)	Other Items (Fri)
1	8/25	Introduction	Ch.1, notes				Resume
2	9/1	Fundamental concepts			Opt	T0	
3	9/8	Objects and fields	#1, 2	P1	Opt		
4	9/15	Semantics and ontology; Lynda SQL videos (for T1)	#3	B1	Opt	T1	B1 Reply
5	9/22	Time in GIS	Ch.2, notes #4-6	P2	Opt		
6	9/29	Data modeling I: E-RD Lynda, Hecker videos (for P3)	#7	B2	Opt	T2	B2 Reply
7	10/6	Surfaces and 3D GIS	Ch.3, notes	P3	Opt		Module1
8	10/13	Spatial data formats	Ch.4, notes	B3	Opt	T3	B3 Reply
9	10/20	Real-world geodatabase		P4	Opt		Module2, Module3
10	10/27	Data modeling II: E-RD & UML Lynda, Hecker videos (for P5)	#9		Opt	T4	
11	11/3	Advanced topics I; Project	Ch.5, notes	P5	Req		Project Abstract
12	11/10	Advanced topics II; Project	Ch.6, notes		Req		
13	11/17	Advanced topics III; Project	#10		Req		
14	11/24	Project Work			Req*		
15	12/1	Project Work		Project Report			Project Preso
	12/5	End of semester; all written work due this date					

* Held on Mon/Tue before Thanksgiving

B = Blog, P = Paper, T = Tutorial