SSCI 582, Spatial Databases

Units: 4

Term—Day—Time: Spring, 2015 - online

Location: online, via Blackboard

Instructor: Jordan T. Hastings, PhD
Office: Reno, Nevada
Office Hours: I am available most afternoons (Pacific Time) via Blackboard and email.

I typically hold open recitation sessions on Wednesday and Thursday evenings via Adobe Connect. I am also available for private chats on AdobeConnect or Bluejeans <u>by prior arrangement</u> 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 (forums) so that we can share the knowledge among students in the most efficient way. I subscribe to the Blackboard forums and usually review them nightly. **My priority is to read/respond to emails first, then forums.**

Contact Info: jthastin@usc.edu, 775-771-3166 (mobile)

Adobe Connect: http://usccollege.adobeconnect.com/jthastin
(call-in: 866-637-1762)

IT Help: Richard Tsung.
Hours of Service: Mondays to Fridays, 9:00 a.m.-5:00 p.m.
Contact Info: ctsung@usc.edu, 213-821-4415(office)

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 capstone term project involves building a prototype geodatabase and associated GIS, which may be a preset one or a topic of interest to the student, pre-agreed with the instructor. This term 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:

➢ 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.

Prerequisite(s): None
Co-Requisite (s): None
Concurrent Enrollment: At most one other class
Recommended Preparation: SSCI581

Course Notes

This online course can be pursued entirely asynchronously; however, it also offers synchronous Web-based seminars, which are optional but strongly recommended during the first ten weeks, 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.

All course materials and correspondence are handled via Blackboard; it is here that the day-to-day flow of the class is recorded. Students gain access to this course at noon (Pacific Time) on the first day of classes and progressively on a ~weekly basis thereafter.

Blackboard also hosts discussion forums related to various course topics. These forums facilitate students providing support to each other while working through the course materials, as in a GIS lab setting. The instructors check the discussion forums periodically and may offer occasional comments.

A browser-based Web-conferencing service called Adobe Connect™ is used for the synchronous seminar-style sessions. For groups of four or more, we generally use a companion telephone for improved audio.

Video-chat technologies such as Bluejeans™ (http://dornsife.usc.edu/bluejeans) and Skype™ (www.skype.com) are also used for individual meetings.

Technological Proficiency and Hardware/Software Required

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 tele-sessions.
➢ A modern Web browser (Firefox or Opera 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 is one required text for this course, available from the USC Bookstore or online outlets such as Amazon. Note also that this text is available 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

For each chapter of this text, referred to as "Y&H", the GIST faculty has produced some reading notes to help you work through this material. Individual Y&H chapters and the reading notes will be supplied by the instructor via Blackboard.

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

Couclelis, Helen. 1992. "People manipulate objects (but cultivate fields): Beyond the raster-vector debate in GIS." In *Therories 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.

Mark, David M, and Andrew G. Turk. 2003. Landscape categories in Yindjibarndi: Ontology, environment, and language. Vol. LNCS 2825, in *Spatial Information Theory: Foundations of Geographic Information Science*, edited by Werner Kuhn, Michael F. Worboys and Sabine Timpf, 28-45. Berlin: Springer.

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, three Esri Web Campus (http://training.esri.com) modules are supplied with this course.

➢ Getting Started with Geodatabase
➢ Getting Started with Geodatabase Topology
➢ Working with Geodatabase Domains and Subtypes

An optional module, of value both to neophyte users of ArcGIS Desktop, and to GIS professionals as an update/refresher, is available on request during the first two weeks of class.

➢ Learning ArcGIS Desktop (for ArcGIS 10)

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 papers and review blogs on database theory, and complete a set of practical Esri-related Web trainings during the first ten weeks of class; thus prepared, they undertake the term project during the last five weeks.

Theory (37%): Students complete five multi-part writing assignments and associated exercises, termed "papers", and four topical reviews, structured as "blogs", during the first ten weeks of class. These assignments cover essential theoretical material and perspectives, intended to help integrate practical aspects of Esri geodatabases (below).

Practice (36%): Students also work four hands-on tutorials with databases and ArcGIS on the GIST Server, and concurrently complete three Esri Web Campus modules on geodatabases, during the first ten weeks of class. A primer on ArcGIS Desktop is also available on a voluntary basis. These assignments teach practical skills, required to complete the term project (below).

Term Project (20%): During the last five weeks of class, students work individually or in small teams (2-4 max) on projects determined in consultation with the instructor, to develop a prototype geodatabase with sample data and a supporting map display. Paired-projects are especially encouraged, 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 appropriate spatial and non-spatial data, importing those data into a suitably designed geodatabase, producing and interpreting maps, etc. Some term projects in this course evolve into, or help shape, thesis proposals, too.

Class Participation (7%): Students are required to update their resume and to actively engage with their classmates in this course. From the outset, students do peer-review and co-writing assignments. For each Tutorial, two students are appointed as proctors, to pre-work the material, consulting with the instructor as needed, then assisting other students with it if requested.

During the last five weeks of the class, students will be mostly doing paired-work on term projects; the instructor may also participate. Students are expected to maintain written log of insights and observations during the project development process, and this log is reflected in participation, too.

Careful planning and a serious, consistent commitment will be required for you to successfully navigate the various deliverables in this course, particularly if it is taken concurrently with other courses.

Assignment Submission Policy

Assignments will be submitted for grading via Blackboard using the due dates specified in the Course Schedule below. Particularly in peer review and group exercises, including the term project, it is each student's responsibility as a professional to meet time and product commitments with classmates.

Because of the cooperative nature of this course, and databases generally, adherence to the schedule is imperative. Late assignments will be docked 20% and no grade will be given for assignments turned in more than one week late. Also, no written work will be accepted after 5:00 p.m. PT on the last day of classes.

Additional Policies

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 even if it contains in my judgment an excess of writing other than your own. Refer to the "Statement on Academic Integrity" section and check the website: http://plagiarism.org

Grading Breakdown

Assignments	Number	Points Per Assignment	Total Points
Student Resume	1	2	2
Writing exercises (Papers)	5	5	25
Review exercises (Blogs)	4	3	12
Esri WebCampus modules	3	2	6
Geodatabase Tutorials	4	6-9	30
Participation	-		5
Term project, components			
- Design report	1	7	7
- GIS DB implementation	1	8	8
- Oral presentation, Q&A	1	5	5
Totals	**20**	**-**	**100**

Course Schedule: Weekly Breakdown

	Topics/Daily Activities	Readings and Assignments	Deliverables/Due Dates
Week 1 1/12	**Getting Started**	Longley&al(2005)-Ch.3 **Student Resume** (SR)	Fri 1/16, SR
Week 2 1/19	**The Big Picture; Online Tech-Check** (opt)	Y&H-Ch.1 **Paper1** (P1), **Tutorial1** (T1)	Fri 1/23, Revised SR Mon 1/26, P1: What is a Lake?
Week 3 1/26	**Objects and Fields; MS Access**	Y&H-Ch.2 **Blog1** (B1): Couclelis (1992)	Fri 1/30, B1: Objects&Fields Sat 1/31, T1: MS Access
Week 4 2/2	**Semantics and Ontology**	Hunter(2002); Mark&Turk(2003) **Paper2** (P2), **Tutorial2** (T2)	Mon 2/9, P2: W. Aust. Lakes
Week 5 2/9	**Terrain 2.5D; MS SQLServer**	**Blog2** (B2): Wilson&Gallant(2000)	Fri 2/13, B2: Terrain Sat 2/14, T2: SQL Access
Week 6 2/16	**E-R Modeling**	Y&H-Ch.3, to p.55 **Paper3** (P3), **Tutorial3** (T3)	Mon 2/23, P3: Antarctic Lakes
Week 7 2/23	**Esri Geodatabases (I)**	Esri Web Campus (WC): 1. Getting started with the geodatabase	Fri 2/27, Esri WC: Cert 1 Sat 2/28, T3: GeoDB (I)
Week 8 3/2	**DB Normalization**	Y&H-Ch.3, from p.56 **Paper4** (P4), **Tutorial4** (T4)	Mon 3/9, P4: N.A. Great Lakes
Week 9 3/9	**Esri Geodatabases (II)**	Esri Web Campus (WC): 2. Getting started with topology & 3. Working with domains and subtypes	Fri 3/13, Esri WC: Certs 2&3 Sat 3/14, T4: GeoDB (II)
3/16	*Spring Break*		
Week 10 3/23	**Time in GIS** **Term Project – kickoff**	**Blog3** (B3): Peuquet(1999)	Fri 3/27, B3: Time Mon 3/30, TP: Topic Selection
Week 11 3/30	**Legacy Geodata formats** **Term Project - grouping**	Y&H-Ch.4 **Paper5** (P5)	Mon 4/6, P5: WUS Paleolakes
Week 12 4/6	**Metadata** **Term Project – week1**	Y&H-Ch.5 **Blog4** (B4): Guptill (1999)	Fri 4/10, B4: Metadata Mon 4/13, TP: Log Update1

Week 13 4/13	**Term Project – week2**		Mon 4/20, TP: Log Update2
Week 14 4/20	**Term Project – week3**		Mon 4/27, TP: Log Update3
Week 15 4/27	**Term Project – week4** *Final Presentations*		Tue 4/28 - Fri 5/1,TBA (Doodle) *varies* TP: Presentations
FINALS 5/5	**NO Classes**		

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/1100-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* http://sait.usc.edu/academicsupport/centerprograms/dsp-home_index.html 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.

[end/5A06]