Term Information

Effective Term	Autumn 2015

General Information

Course Bulletin Listing/Subject Area	Geography
Fiscal Unit/Academic Org	Geography - D0733
College/Academic Group	Arts and Sciences
Level/Career	Graduate, Undergraduate
Course Number/Catalog	5212
Course Title	Geospatial Databases for GIS
Transcript Abbreviation	Geospatial Data
Course Description	This course focuses on designing, implementing, querying and managing spatial databases or persistent data stores where most entities have footprints in geographic space and time. This is critical for designing and implementing GIS for projects and organizations. It is also crucial for moving beyond GIS to the bigger world of geographic information services.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Prereq: 5210
Exclusions	

Cross-Listings

Cross-Listings	

Subject/CIP Code

Subject/CIP Code	45.0701
Subsidy Level	Doctoral Course
Intended Rank	Senior, Masters, Doctoral

Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors

Course Details

Course goals or learning objectives/outcomes

- Understand database design with spatial objects;
- Be able to write spatial queries;
- Understand physical data storage and performance tuning;
- Understand spatio-temporal and moving objects data;
- Have practical GIS data skills

Content Topic List

- GIS
- Spatial databases
- Spatial queries
- Spatial data modeling

Attachments

- GEOG 5212 generic syllabus.pdf: GEOG 5212 syllabus

  (Syllabus. Owner: Miller,Harvey Jay)
- Updated curriculum map - Au 2014 v2.xlsx: Updated curriculum map

  (Other Supporting Documentation. Owner: Miller,Harvey Jay)
- Memo - 5000-level designation for GEOG 5212.pdf: 5000-level designation for GEOG 5212

  (Other Supporting Documentation. Owner: Miller,Harvey Jay)

Comments

- CSE concurrence is in progress. *(by Miller,Harvey Jay on 11/22/2014 12:56 PM)*
- See 10-21-14 e-mail to H. Miller. *(by Vankeerbergen,Bernadette Chantal on 10/21/2014 12:04 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Miller,Harvey Jay	08/27/2014 03:14 PM	Submitted for Approval
Approved	Miller,Harvey Jay	08/27/2014 03:15 PM	Unit Approval
Approved	Haddad,Deborah Moore	08/27/2014 07:53 PM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	10/21/2014 12:04 PM	ASCCAO Approval
Submitted	Miller,Harvey Jay	11/23/2014 09:42 AM	Submitted for Approval
Approved	Miller,Harvey Jay	11/24/2014 09:23 AM	Unit Approval
Approved	Haddad,Deborah Moore	11/24/2014 11:00 AM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole	11/24/2014 11:00 AM	ASCCAO Approval

GEOGR 5212 Spatial Databases for GIS - Spring, 2015

Instructor	Harvey J. Miller
Lecture/lab meeting time and location	Mondays, Wednesdays 11:10am-12:30pm Derby Hall 0140 (a computer lab with desktop computers and ArcGIS software)
Office hours and location	Mondays, Wednesdays 9:00am – 10:30am Derby Hall 1176
Phone	614-292-5207
Internet	miller.81@osu.edu
Website	https://u.osu.edu/miller.81/

Course prerequisite

GEOG 5210 Fundamentals of GIS

Texts

1. Required
   - (WD) Worboys, M. and Duckham, M. (2004) *GIS: A Computing Perspective*.
   - Other readings – see course outline and schedule**.**
2. Optional
   - (SC) Shekhar, S. and Chawla, S. (2003) *Spatial Databases: A Tour*.
   - Zeiler, M. (2010) *Modeling Our World: The ESRI Guide to Geodatabase Concepts*, second edition.

Course description

The future will be data-driven. Most scientific and professional enterprises, as well as consumers, are generating and using data in most activities. Much of these data will be georeferenced and have geospatial footprints.

This course focuses on designing, implementing, querying and managing *spatial databases* or persistent data stores where most entities have footprints in geographic space and time. This is critical for designing and implementing GIS for projects and organizations. It is also crucial for moving beyond GIS to the bigger world of *geographic information services*.

In designing any GIS project, a fundamental decision is how to represent the world of interest in the computer. This is critical since no GIS or spatial analysis tools – no matter how powerful – can extract more information than is designed in the database representation. The growing size of geospatial databases requires these databases to support efficient querying and searching. A well designed spatial database can also evolve as the questions in the project or organization change over time. A poorly designed spatial database is difficult to rewind and fix.

Understanding spatial database design and management is not only essential for designing and implementing GIS, but also to support a much wider range of geographic

information services such as Google Maps and location-based services such as the location apps on your smartphone. This is a much bigger market than the market for professional GIS services.

Database technology

The most common spatial database management system (SDBMS) technology is a specialized object-relational database management system (ORDBMS). An ORDBMS supports objects within a relational (table-based) database and its associated query language, Structured Query Language (SQL). An ORDBMS is a SDBMS if it also supports spatial objects through spatial indexing and spatial (geometric) operations.

ORDBMS with spatial objects is the approach used by ESRI's Geodatabase as well as open-source software such as PostGreSQL/PostGIS. It is also supported by other major vendors such as IBM.

In this course, we will be working with ESRI's ArcGIS Geodatabase. There will be a series of assignments using this technology. These will be provided via Carmen and discussed in class.

Learning objectives

After successful completion of this course, you should:

1. Understand database design with spatial objects;
2. Be able to write spatial queries;
3. Understand physical data storage and performance tuning;
4. Understand spatio-temporal and moving objects data;
5. Have practical GIS data skills

Evaluation

Examinations: 50% of the final grade
Labs: 50% of the final grade
Grading scale: (OSU standard scale) A 93-100%; A- 90-92%; B+ 87-89%; B 83-86%; B- 80-82%; C+ 77-79%; C 73-76%; C- 70-72%; D+ 67-69%; D 60-66%; E 0-59%

Examinations

Examinations will be administered using CARMEN during regular class time using the computers in Derby 0140. There will be 5 short midterm examinations, consisting of 20-25 multiple choice, matching and true/false questions.

Labs

The labs will involve the process of designing, building, querying and maintaining a spatial database. These will be software-based, focusing on the ArcGIS Geodatabase technology from ESRI, Inc. The labs will involve an in-class demonstration and supervised activity, followed by an assignment to be completed on your own within a designated time limit.

Policies

1. **Disability services.** Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/

2. Academic misconduct. It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct: http://studentlife.osu.edu/pdfs/csc_12-31-07.pdf

3. Technology policy: This is the 21st century, so I will not ban the use of laptops, tablets and other digital devices. However, there are some guidelines and restrictions:
Be mindful – when you are emailing, tweeting, texting, updating, surfing, etc. you are not paying attention. Research shows that no one can multitask that well – not even you. Paying attention and taking good notes is essential to success in this course. Why are you here?
Be courteous – your use of digital devices should not distract other students in the class. It is unlikely that taking notes or searching class-relevant topics will be distracting. However, viewing videos of kittens or ice bucket challenges will likely distract others. Complaints about inappropriate technology use in class will result in your privileges being curtailed or revoked.
Be honest - emailing, surfing, and the use of any other applications or technologies is not allowed during the computer-based examinations. Be aware that your activity on the lab desktop computers may be monitored during exams.

Carmen

You are responsible for all announcements, additional reading, assignments and other material posted at the Carmen 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 and schedule (assume Spring 2015)

Topic	**Readings**	**Date**
Course overview	Syllabus	12 Jan 2015
Introduction		
Introduction to databases	WD 1-43	14 Jan 2015
Introduction to spatial databases	SC 1-20	21 Jan 2015
Spatial object-relational databases	Zeiler 1-19	21 Jan 2015
Exam 1: 26 Jan 2015		
Object-relational databases and spatial objects		
Relational databases	WD 43-45	28 Jan 2015
Database development	WD 55-71	28 Jan 2015
Object-orientation and spatial objects	WD 71-82	2 Feb 2015
Relational algebra and SQL		
Overview of relational algebra and SQL	WD 46-52	4 Feb 2015
Examples	SC 52-82	9 Feb 2015
Exam 2: 11 Feb 2015		
Structures and access methods		
General database structures and access	WD 221-229	16 Feb 2015
From one to two dimensions	WD 229-234	18 Feb 2015
Raster structures	WD 234-240	23 Feb 2015
Point structures	WD 240-248	25 Feb 2015
Linear objects	WD 248-250	2 March 2015
Object collections	WD 250-255	4 March 2015
Spherical data structures	WD 255-258	9 March 2015
Exam 3: 11 March 2015		
Architectures		
Hybrid, integrated and composable architectures	WD 259-262	23 March 2015
Syntactic and semantic heterogeneity	WD 262-266	25 March 2015
Distributed systems	WD 266-278	30 March 2015
Location-aware computing	WD 278-291	1 April 2015
Exam 4: 6 April 2015		
Time		
Introduction	WD 359-367	8 April 2015
Temporal databases and versioning	WD 367-371	13 April 2015
Spatio-temporal databases	WD 371-382	15 April 2015
Moving objects concepts	Andrienko et al. (2008)	20 April 2015
Moving objects databases	Frentzos et al. (2008)	22 April 2015
Exam 5: 27 April 2015		

Readings:

1. **Andrienko et al. (2008)**: Andrienko, N., Andrienko, G., Peelkis, N. and Spaccapetra, S. (2008) “Basic concepts of movement data,” in F. Gianotti and D. Pedreschi (eds.) *Mobility, Data Mining and Privacy*, Springer.
2. **Frentzos et al. (2008):** Frentzos, E., Pelekis, N., Ntoutsi, I. and Theodoridis, Y. (2008) “Trajectory database systems,” in in F. Gianotti and D. Pedreschi (eds.) *Mobility, Data Mining and Privacy*, Springer
3. **SC 1-20**: Chapter 1 of Shekhar and Chawla.
4. **SC 52-82**: Chapter 3 of Shekhar and Chawla.
5. **WD** : Worboys and Duckham
6. **Zeiler 1-19**: Chapter 1 of Zeiler (2010)

TO: Social and Behavioral Sciences Panel, ASC Curriculum Committee
FROM: Harvey Miller, Department of Geography
RE: 5000-level designation for GEOG 5212
DATE: 18 November 2014

This memo concerns justification of the 5000-level designation for the proposed GEOG 5212 Geospatial Databases for GIS. We expect both undergraduates and graduates to enroll for credit in this course, hence the requested 5000-level designation. Both undergraduate and graduate enrollment for credit in our GIS courses is common. To illustrate, the table below provides recent enrollments for the Department of Geography's current 5000-level GIS courses.

ENROLLMENTS	SPRING 2014		AUTUMN 2014	
Geography Course	GRAD	UGRD	GRAD	UGRD
GEOG	23	109	41	214
5100			3	22
5200			2	45
5201	3	22		
5220	8	46	20	74
5221			7	34
5222	1	22	1	25
5224			8	14
5270	1	19		
8102	10			
Grand Total	**23**	**109**	**41**	**214**