GEOG 5212 Geospatial Databases for GIS – Autumn 2017

Meeting Times: Tuesdays & Thursdays, 11:10am – 12:30pm; Derby Hall 135

Instructor Name and Email: Dr. Emily S. Castellucci, castellucci.5@osu.edu
Office Hours and Location: My office is Derby Hall 1168. My office hours are by appointment only. If you would like to schedule a meeting with me, please visit my scheduling website: https://emilycastellucci.clickbook.net/. If you cannot make your appointment, please cancel.

Teaching Assistant Name and Email: Rebecca Chapman, chapman.751@buckeyemail.osu.edu
Office Hours and Location: Thursdays, 9am-11am, Derby Hall 1155

Course Description: This course focuses on designing, implementing, querying and managing geospatial 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 Technologies: 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 and PostGreSQL/PostGIS. There will be a series of assignments using this technology. These will be provided via the course website 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, and
5.   Have practical GIS data skills.

Textbook: None. All readings and resources will be provided on the course website.
- **B**: Bolstad, P. (2016). *GIS Fundamentals*, 5th edition.
- **BK**: Buliung, R. (2004). On design and implementation of an object-relational spatial database for activity/travel behavior research. *Journal of Geographical Systems, 6*, 237-262.
- **CM**: Coronel, C. & Morris, S. (2016). *Database Systems: Design, Implementation, and Management*, 12th edition.
- **EN**: Elmasri, R. & Navathe, S. (2016). *Fundamentals of Database Systems*, 7th edition.
- **Nav**: Navathe, S. B. (1992). Evolution of data modeling for databases. *Communications of the ACM, 35*(9), 112-123.
- **Nas**: Nasser, H. (2014). *Learning ArcGIS Geodatabases*.
- **OH**: Obe, R. & Hsu, L. (2015). *PostGIS in Action,* 2nd edition.
- **R+**: Rigaux, P., Scholl, M., & Voisard, A. (2002). *Spatial Databases with Application to GIS*.
- **RG**: Ramakrishnan, R. & Gehrke, J. (1999) *Database Management Systems*, 2nd edition.
- **S+**: Shekar, S., Chawla, S., Ravada, S., Fetterer, A., Liu, X., & Lu, C. (1999). Spatial Databases – Accomplishments and Research Needs. *IEEE Transactions on Knowledge and Data Engineering, 11*(1), 45-55.
- **SC**: Shekhar, S. & Chawla, S. (2003) *Spatial Databases: A Tour*.
- **SX**: Shekhar, S. & Xiong, H. (2008). *Encyclopedia of GIS*, 623-630.
- **WD**: Worboys, M. & Duckham, M. (2004) *GIS: A Computing Perspective*, 2nd edition.
- **WH**: Waugh, T. & Healey, R. (2010). The GEO VIEW design: A relational data base approach to geographical data handling. *International Journal of Geographical Information Systems, 1*(2), 101-118.
- **Z**: Zeiler, M. (2010) *Modeling Our World: The ESRI Guide to Geodatabase Concepts*, 2nd edition.

Evaluation:
- *Labs*: 48%
  - The labs will involve the process of designing, building, and querying a spatial database.
  - You will have exactly 1 week to complete each lab, unless otherwise noted. Labs will be due at the beginning of the next lab meeting, i.e. at 11:10am (*not* 11:59pm). Your lowest lab grade will be dropped.
  - Do not expect to complete all of your lab work during the scheduled lab time. You may need to dedicate time outside of class to completing your labs.
- *Examinations*: 42%
  - There will be 3 exams, consisting of multiple choice, matching, true/false, and other questions, which will be administered via the course website. You must be present in class on the day of the exam to take the exam.
  - Exam questions and answers will not be available to you after you complete the exam. If you wish to review your exam, you will need to schedule a meeting with your instructor.

- *Participation*: 10%
    - o Small assignments may be assigned in class or to be completed on your own time. These will be applied to your participation grade in this course.
    - o Attendance is required and wills be recorded at all class meetings. You are allowed to miss only 2 class meetings without penalty.
    - o If you need to request an excused absence (e.g. due to illness, etc.), you are required to complete the Request for Excused Absence Form.
- *Grading Scale* (OSU standard scale):

o	A	93-100%	o	B-	80-82%	o D+	67-69%
o	A-	90-92%	o	C+	77-79%	o D	60-66%
o	B+	87-89%	o	C	73-76%	o E	0-59%
o	B	83-86%	o	C-	70-72%		

    Note: Your final grade as seen on the course website will be rounded to the nearest whole number (e.g. an 89.49 is a B+ but an 89.50 is an A) before being submitted to the University Registrar at the end of the semester.

Policies:
1. *Email correspondence policies.*
    a. You are responsible for all course related emails, so be sure to check your email frequently (i.e. daily on weekdays).
    b. When emailing your instructor at castellucci.5@osu.edu, always include the course number (e.g. 5212, etc.) somewhere in the subject or body of the email. (This is important since your instructor teaches multiple classes and needs to know to which class you are referring.)
2. *Course website policy.* You are responsible for all announcements, additional reading, assignments and other material posted at the Canvas site, so be sure to check it frequently (i.e. daily on weekdays). Note:
    a. You may find that it helps to update your notifications. You can do this by going to Account > Notifications. There are four notification options, and I suggest that you turn on "Notify me right away" or at least "Send daily summary" for everything until you figure out which notifications are most beneficial to you.
    b. There is a Canvas app available for iPhone and Android, which you may find beneficial for keeping up with the course website.
3. *Lab questions policies*.
    a. On the course website, there will be a discussion for each lab. If you have questions about labs outside of the scheduled lab time, you are required to use the appropriate discussion to post your questions. Your instructor and TA will be notified of your post and will respond as soon as possible. Please do NOT email your lab-related question to your instructor or TA, unless it is a grade-related question.
4. *Late policies*.
    a. All course assignments, other than labs, will not be accepted late.
    b. Labs will be accepted through the date the last lab is due, but late labs will be penalized 1 point for each business day late, up to 10 business days.

        i.   For example, if your lab is due at 11:10am on Thursday, then a lab that is submitted

1. at 11:10am on Thursday is on time.
2. at 11:11am on Thursday is late 1 business day (-1).
3. at 11:10am on Friday is late 1 business day (-1).
4. at 11:11am on Friday is late 2 business days (-2).
   etc.

        ii.   It is possible for the late penalty to exceed the number of points awarded for correct answers, but a zero (not a negative number) will be assigned in these cases.

  c. Extensions will not be granted due to lost work; be sure you back up and keep all of your work.

5. *Exam policies*.
   a. Exams must be taken at the scheduled time, unless you have submitted the [Request for Excused Absence Form](), and it has been approved by the instructor. Please contact your instructor in advance of the scheduled exam to schedule a make-up exam, except in the case of emergency.
   b. You are expected to arrive to all exams *on time*. Students who arrive late to the exam will be permitted to begin the exam, until the first student leaves. After a student completes the exam and leaves, students who arrive late will not be permitted to begin the exam, will be asked to leave, and will be considered absent. Your absence will be considered unexcused, unless you submit a [Request for Excused Absence Form](), and it is approved by the instructor.
   c. Make-up exam penalties:
      i. Make-up exams for excused absences will not be penalized.
      ii. Make-up exams for unexcused absences will be penalized 15%.
   d. You are expected to finish all exams *on time*. Exams begin when schedule class time begins, and exams end when the scheduled class time ends. At the end of the scheduled class time, you are to stop working and turn in your exam. You may not continue working on your exam after the scheduled class time.

6. *Disability services policy*. 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 098 Baker Hall, 113 W. 12th Ave, Columbus, OH 43210; telephone 292-3307; VRS 429-1334; http://www.ods.ohio-state.edu/.

7. *Academic misconduct policy*. 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

Classroom and Computers:
You must swipe your BuckID to access the classroom in Derby 0135. (Note: The card scanners are sometimes unreliable. You may need to swipe more than once, and you may need to wait a second or two after swiping to open the door, giving the scanner a chance to unlock the door. If you continue to have problems, please notify the office staff in Derby 1036.)

To access the computers in Derby 0135 and 0140, you may use the following login information:
- Username: G5212
- Password: Geog-5212AU17

To access the internet, you need to visit the following website and login:
https://nauth1.auth.infosec.ohio-state.edu

If you need to return to the computer lab outside of class time, please be aware that the building is usually locked at night, over weekends, and on holidays, so be sure to plan accordingly. When you do return to the computer lab outside of class time, there may be a class in session. Please attempt to avoid interrupting classes that are in session, and if there *is* a class in session, check the computer lab across the hall in Derby 140. It has the same software as Derby 135, and it is usually available.

If you would like to check the schedules for Derby 135 and 140, you can check the Room Matrix:
https://delegated.osu.edu/psp/csosuda_1/EMPLOYEE/CAMP/c/OSR_CUSTOM_MENU.OSR_ROOM_MATRIX.GBL
1. Enter DB0135 for Derby 135 or DB0140 for Derby 140.
2. Select the date under "Show Week of".
3. Click "Refresh Calendar".
You will be able to see when the room is occupied and when the room is available.

Software:
You are NOT required to download the software we will be using in the course onto your own computer. However, information on obtaining ArcGIS is provided here:

1) *ArcGIS*. You may request a 1-year student trial license from your TA. Just email your TA, and your TA will send you an activation code. You will then need to activate the code and download the software here:
http://www.esri.com/software/landing_pages/arcgis/desktop-ed. (If you want your version to match the version used on the lab computers this semester, you'll want to choose 10.4.1.)

If you choose to go this route, there is a detailed document regarding the entire process of downloading and installing ArcGIS and authorizing it using an authorization code available on the course website, entitled ESRI_installation_tips.pdf. If your installation-related questions are not answered by this document, you will need to contact ESRI Customer Support at 1 (888) 377-4575.

Please note that ArcGIS for Desktop is NOT certified or supported on the Mac operating system. However, if you have an Apple computer running Windows, you can install ArcGIS for Desktop using VMWare, BootCamp, or Parallels. To learn more, please visit this link: http://edcommunity.esri.com/software-and-data/mac-os-support.

2) *Other software.* If you choose to install any other software that we are using in this course onto your personal machine, your instructor and TA are NOT responsible for answering your installation-related questions. You will need to troubleshoot such issues yourself.

Disclaimer: This course syllabus provides a general plan for the course; deviations may be necessary. Any changes will be announced by the instructor with as much advance notice as possible.