

GEOG 242 –001: INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEMS FOUNDATIONAL STUDIES: QUANTITATIVE LITERACY

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Office Hours: Tuesdays 10am to 12pm, Wednesdays 1pm to 3pm, or by appointment

General Class Schedule & Location

Monday, Wednesday, Friday 9am – 9:50am

Classroom: 158 Science Hall

Course Description

This course is intended to introduce students to the fundamentals of geographic information systems (GIS), a rapidly developing and widely used set of analysis and data management techniques applied to spatial data. The basic design of the course is to teach the principles of quantitative literacy through mapping and spatial analysis. This course meets the foundational studies requirement for quantitative literacy.

GIS techniques are applied to real problems in diverse fields such as environmental management and assessment, city planning, economics, geology, aviation, military and intelligence fields, public health, criminal justice, political science, business, and human development. This course will provide the conceptual and technical foundation necessary to employ quantitative spatial data to provide solutions to problems of interest to you, your community, and current or future employer. The capability to employ data and models to solve real-world problems is a primary goal of the Quantitative Literacy component of the Foundational Studies Program at ISU.

Course meetings will be largely lecture-based, with activities and hands on exercises interspersed throughout. You will become familiar with ArcGIS, an industry-standard geographic information systems software package, as well as general GIS terms and concepts which will enable you to adapt to other software systems. Through class exercises and the knowledge you gain from lectures, you will produce results which will answer real-world questions of interest to our local community by applying GIS as a critical toolset widely known as GIScience. You will also become familiar with geographic data (including satellite imagery and air photographs) – how to describe it, find it, use it -- and select the data appropriate for a given task. This course will enable you to further pursue courses in geospatial techniques, but also show you how quantitative data can suggest solutions to real policy questions.

Course Objectives, Goals, and Applied Skills

At the end of this course, you will meet the learning objectives for the Quantitative Literacy category of the Foundational Studies curriculum. These objectives ensure that a student taking a Quantitative Literacy (QL) course will be able to:

1. Solve for one or more unknowns from available information using appropriate methods;
2. Represent and solve real-world problems employing appropriate mathematical models;
3. Answer questions using empirical methods; and
4. Critically evaluate a quantitatively-based argument.

As a foundational studies course, there are overarching goals which we will also work to meet in this course. Specifically, the design of the Foundational Studies (FS) program at ISU is to ensure that students will be able to perform the following by the end of their studies at the university:

1. Locate, critically read, and evaluate information to solve problems;
2. Critically evaluate the ideas of others;
3. Apply knowledge and skills within and across the fundamental ways of knowing (natural sciences, social and behavioral sciences, arts and humanities, mathematics, and history);
4. Demonstrate an appreciation of human expression through literature and fine and performing arts;
5. Demonstrate the skills for effective citizenship and stewardship;
6. Demonstrate an understanding of diverse cultures within and across societies (*not explicitly addressed in this course*);
7. Demonstrate the skills to place their current and local experience in a global, cultural, and historical context;
8. Demonstrate an understanding of the ethical implications of decisions and actions;
9. Apply principles of physical and emotional health to wellness (*not explicitly addressed in this course*);
10. Express themselves effectively, professionally, and persuasively both orally and in writing.

Finally, the Foundational Studies program also helps you to develop a set of skills (known as Skill/Applied Learning Objectives, SAL) which you will be able to apply broadly in your academic, personal, and professional life:

1. Explicitly demonstrate how the curriculum will develop critical thinking skills
2. Explicitly demonstrate how the curriculum will develop information literacy skills
3. Include a graded writing component, which whenever possible is developmental

Applying these learning objectives to the course material, by the end of this course you will:

1. Employ GIS to uncover human and environmental processes which create various patterns in the landscape; [meeting objectives QL-1, FS-2, FS-3, FS-5]
2. Know how to accurately represent real-world phenomena in a GIS, and how to employ GIS algorithms to suggest solutions to real problems; [meeting objectives QL-2, FS-1, FS-3, FS-5, FS-8]
3. Critically evaluate whether the GIS methods employed in a study are adequate, and how they could be improved or employed differently. [meeting objectives QL-4, FS-2, FS-3, FS-8, FS-10]
4. Employ GIScience to complete your own research project (with the help of the instructor), then present it to your peers in a poster session, and participate in peer-evaluation. [meeting objectives QL-1, QL-2, QL-3, QL-4, FS-1, FS-3, FS-4, FS-5, FS-10]

By the end of this course we will have covered material and completed activities which address all of the Quantitative Literacy learning objectives, all of the Skill/Applied learning objectives, and all but two of the overarching Foundational Studies learning objectives (numbers 6 and 9).

Course Texts & Readings

There is one required book for this course, which is available at the Indiana State University bookstore in the Hulman Student Center or as an e-book from the publisher (for a reduced price):

- **DeMers, Michael N. 2008. Fundamentals of Geographic Information Systems, 4th Edition. Wiley Publishers.**

In addition, we may have assigned readings during the week, generally only one or perhaps two, made available for download as PDF documents on Blackboard. Course readings should be completed as indicated in the course schedule attached to this syllabus.

Course Prerequisites and Requirements

There are no prerequisites for this course, but the assumption of this instructor is that each student in the class is able to complete basic computer tasks such as file management on Windows PCs. I will only provide initial assistance in basic computer problems, particularly with regards to file management ("I can't find my file" or "my file just disappeared" are generally not acceptable excuses or problems in this course). The Center for Instructional Research and Technology offers courses free of charge to students who may have difficulty performing general computer tasks (<http://www1.indstate.edu/cirt/td/>).

Academic Honesty

Students at Indiana State University are expected to accept certain personal responsibilities that constitute the "standard" for behavior in a community of scholars, and this course is no exception. The "Sycamore Standard" entails a number of things which can (and should) be reviewed here: <http://www1.indstate.edu/studentaffairs/docs/syc-strd.pdf>

Students with Special Considerations

Indiana State University seeks to provide effective services and accommodation for qualified individuals with documented disabilities. If you need an accommodation because of a documented disability, you are required to register with Disability Support Services at the beginning of the semester. Contact the Director of Student Support Services. The telephone number is 237-2301 and the office is located in Gillum Hall, Room 202A. The Director will ensure that you receive all the additional help that Indiana State offers. If you will require assistance during an emergency evacuation, notify your course instructor immediately. Look for evacuation procedures posted in your classrooms. **Athletes** will need to provide documentation for absences due to competition or training via the Athletic Study Program.

Laptop Not Required for Course: Usage Permitted: While there will be no assignments or examinations for which the laptop will be used, your use of a laptop is generally permitted as long as such usage remains within the bounds of the Code of Student Conduct and it conforms to the provisions of its use as laid out in this syllabus. There may be occasions where laptop usage is forbidden and if that occurs, failure to comply with this direction will be viewed as a violation of the Code of Student Conduct and you will be marked absent for that class meeting.

Course Management and Communication

We will be using Blackboard, Indiana State's online course management system, in this course. When you enroll for the course you are automatically granted access to the GEOG 112 Blackboard page. To login to the page, please go to <https://blackboard.indstate.edu>, and login with your Sycamore login and password. All emails from me to you will use ISU's e-mail system and will be sent to your ISU e-mail account. You will be required to use your ISU e-mail address for this course (*any requests to use another address will not be honored*). All assignments, handouts, assignment scores, and lecture outlines will be

available through Blackboard. Lecture outlines will be available immediately before the scheduled lecture and will remain posted throughout the semester. Specific readings, assignments and events will be posted on the announcements and calendar pages on Blackboard. Be sure to check Blackboard daily.

Academic Freedom

Indiana State University and the American Association of University Professors define academic freedom in a wide-ranging statement which can be accessed at: <http://www.aaup.org/AAUP/pubsres/policydocs/contents/1940statement.htm>. Independent of the topic matter of any content or homework/laboratory exercise, this course will be conducted in a manner which will meet the learning objectives and skills as set forth in the Foundational Studies Program requirements for Quantitative Literacy courses, and your instructor will make every possible attempt to ensure that controversial subject matter unrelated to the course goals will not be introduced.

Course Requirements

[Individual Lab Exercise, Exam, Quiz, and Poster activity descriptions and their associated FS and QL learning objectives, and SAL, are detailed and annotated in the course schedule, below]

A) Attendance (no points awarded):

I will take role in this course, either briefly at the start of class, or through classroom activities which involve submitted materials. Attendance is mandatory, but I am aware that real life sometimes gets in the way of how we think our ideal lives should be. Therefore, every student is allowed three absences over the semester, for whatever reason. Take your absences carefully, though, as for every missed class beyond these three you will be docked 3% (that's right, three percent) of your final grade, regardless of the reason. This means that if you are sick, you will have to use your allotment of 3 absences or face a penalty. NOTE: Certain classroom and communication behavior may lead you to being marked as absent, even if you are physically in the classroom. Please see the course policies page, below.

B) Lab Exercises (400 points):[QL-1, QL-2, QL-3, QL-4, FS-1, FS-3, FS-2, FS-4, FS-5, FS-7, FS-8, FS-10, SAL-1, SAL-2, SAL-3]

Approximately every week we will have hands-on laboratory exercises in-class. These exercises will include homework which may require you to work in the lab in 158 Science Hall, or at home with an evaluation copy of the software, on your own time and on your own computer. Each of these labs will require students to submit a detailed written narrative detailing the data used, analysis steps taken, problems encountered, and interpretation/critical reflection of how these methods could be employed in other settings. These lab activities will be subject to writing standards described in this syllabus, will typically require 2-3 pages of writing, and will be returned to you with comments and suggestions to improve your writing and analysis. The first three lab exercises you turn in can be revised for an improved grade on writing-related problems (though *not* an improved grade for analytical problems or mistakes). Lab exercises are worth variable credit, but generally will be valued at 20-100 points, making up 400 total points.

C) Mid-Term Exam (100 points) and Quizzes (150 points) [Assessment content and strategy listed as annotations to course schedule, below]

The mid-term exam and the three quizzes which come after it will contain a mixture of multiple choice, true/false, graphic interpretation/critique, and short answer/essay questions. The exam will be worth a total of 100 points and will take place on Blackboard. The quizzes will also take place on Blackboard and

will each be worth 50 points. Note that quizzes do not begin until *after* the mid-term and focus primarily assessing your knowledge of the course material and GIS applications.

A note on cheating: I consider cheating to be the copying of other student's answers and/or assisting others when an exam should be completed individually. I do NOT tolerate cheating or other forms of academic dishonesty. Cheating will result in decisive action according to the Academic Honesty policies of Indiana State University (see: <http://www.indstate.edu/academicintegrity/studentguide.pdf>)

Exam and quiz make-up policy: Make-up exams are offered only to those who have made previous arrangements with me and can provide a *documented* and worthy excuse. Should a life circumstance occur at exam time, you need to contact me by email or telephone to let me know you will require a make-up. THIS NOTIFICATION NEEDS TO OCCUR AS SOON AS YOU CAN, BUT NO LATER THAN 24 HOURS AFTER THE EXAM WAS ADMINISTERED, and preferably should be before the exam. Also, though circumstances may be traumatic, do not be surprised if I ask for official confirmation of the event before excusing your absence. Sleeping-in or forgetting an exam are not excuses for which make-ups are offered.

Exam and quiz review: Before an exam, please feel free to ask questions about the material in class or via email, or come to my office hours; exam review sessions will not be provided. After the exam I do not go over exam questions in class, though I am always willing to entertain any specific questions. Also, please feel free to contact me directly with specific issues after class, during office hours, or via email.

D) Final Poster Proposal (50 points) and Poster (200 Points) [QL-1, QL-2, QL-3, QL-4, SAL-2, SAL-3]

In lieu of a final exam you will be required to complete a final research project which answers a question of interest to you *and* the community. Project will be presented as a poster (200 points) and should address a problem which impacts Terre Haute or Central Indiana. Exceptions may be made for students who have research interests which could explicitly integrate GIS in some way, but exceptions will only be granted for well-reasoned and presented proposals. This final project may be undertaken in small groups of no more than 3 people, or completed independently. Keep in mind that creating a poster from scratch is not a simple task and will take serious planning. Typical completion time for a GIS poster is 24 full hours of work *after* the analysis steps have been completed. Before the poster project can begin (or be graded), a 1-page proposal (50 points) outlining the following must be submitted (see schedule for due date): (a) project group members, (b) project description, (c) data availability, and (d) analytical technique likely to be employed. The instructor will work with groups to ensure projects are feasible and well-executed.

E) Other Course Options (20 points):

Only two extra-credit opportunities will be provided during the semester, in the form of a critical evaluation of an academic application of GIS (for a total of 20 points, or a potential 4% bump in your total grade). You will have to evaluate a journal article published in one of the approved journals listed on Blackboard according to the model provided (also on Blackboard). These papers should be 2 (double-spaced, 12-point, Times New Roman, 1-inch margin) pages long. Other extra-credit work will not be considered except under *extraordinary* circumstances.

Course Grading

Your grade will be calculated using the following point system:

Lab Exercises = 400 points

Mid-term Exam = 100 points

Quizzes = 150 Points

Final Poster = 250 Points

TOTAL POTENTIAL = 900 points + 20 Extra-credit points

I will add up your total points, including any earned extra-credit points, and divide that number by 900, yielding your percent grade. I will then assign your grade according to the following scale:

93 – 100% = 4.0 = A

88 – 92% = 3.7 = A-

85 – 87% = 3.3 = B+

81 – 84% = 3.0 = B

76 – 80% = 2.7 = B-

71 – 75% = 2.3 = C+

67 – 70% = 2.0 = C

62 – 66% = 1.7 = C-

59 – 61% = 1.3 = D+

56 – 58% = 1.0 = D

52 – 55% = 0.7 = D-

0 – 51% = 0.0 = F

When calculating final grades, it is my policy to round up only on fractional percentages of 0.5 or more. In other words, if your final grade works out to an 80.5%, it would be rounded up to 81% and you would be assigned a final grade of 3.0 on the above scale. Similarly, if your final grade was 87.3% you would *not* receive the round up and would be assigned a grade of 3.7.

COURSE POLICIES: THE FOLLOWING POINTS & POLICIES ARE VERY IMPORTANT!!!!

- 1) **Please INFORM THE INSTRUCTOR AS SOON AS POSSIBLE if you will have any conflict with class meetings and exam periods due to religious, athletic, or other reasons.**
- 2) **IF YOU HAVE SPECIAL NEEDS, PLEASE INFORM THE INSTRUCTOR AS SOON AS POSSIBLE.** In order to accommodate eligible student disability requests, I need to have confirmation from ISU of your needs before the first exam.
- 3) **Course policies:**
 - a) **Wikipedia & Electronic Resources:** While Wikipedia and other online resources can be incredibly helpful, they are subject to a range of problems that printed and reviewed media (such as journal articles, newspapers, and books) are not. Therefore, in this course, Wikipedia should only be used as a springboard to more formal sources of information. If you are curious or need to know fast-facts about a subject, location, or idea in the class, by all means use Wikipedia. However, Wikipedia sources are unacceptable in papers and assignments. Please make the effort to find conventional resources (if you need a hand finding them or evaluating a source, feel free to contact me!).
 - b) **Communication (especially e-mail):** Electronic communication is quickly becoming the standard method of rapid communication, both socially and professionally. Because we contact friends and family online all the time, online communication often becomes informal. However, because part of your education at ISU includes *professionalization*, all e-mails to me and to other students must include: (1) a greeting (e.g., "Dear _____," "Hello," or the person's name, BUT NOT: "Hey," "Whatup," etc.), (2) an e-mail body that clearly describes your concern, question, or problem and is free of IM/133tspeak, and (3) a closing (e.g., "thank you," "sincerely," or even "thanks"). *I am not an overly formal fellow, but e-mail etiquette is something we can all benefit from.*
 - c) **Citations:** If you use a source, including online material (on Blackboard or otherwise) and the textbook, in your work, you must insert a fully-formed citation. Citation guidelines are available on Blackboard, please look them over so you know how to cite the work of others, and when it is necessary to do so (which is nearly always). Malformed citations or the lack of a citation when one is necessary WILL result in a significant reduction of your grade. Again, any and all questions about this are welcome! Similarly, the source of any geographic data or other information MUST be recognized on your lab exercises and any other material you turn in.
 - d) **Spelling, Grammar, & Punctuation:** We all make mistakes when creating written communications – it is not an easy undertaking. Despite this, it is very important that we all strive to avoid typos, grammar mistakes, and punctuation problems as we will use these skills for the rest of our lives. Therefore, I will tolerate the occasional mechanical issue in written work provided there is no more than one error of each type on each page. Obviously, because the final exam is written during the exam period by hand or hastily on the computer, I will allow more errors; I will tolerate two errors of each type per question. More mechanical errors than these limits will result in lost points.
 - e) **Electronics in the Classroom:** I love my iPod, and my cellphone is a pretty important tool as well, but they will REMAIN OFF while I am lecturing or during class discussions. *Similarly, your electronic gear will be off as well.* Receiving text messages or phone calls during class is unprofessional and unacceptable. *Laptop computers* can be used for note-taking if you must, but as slides will be available before class on Blackboard you may find lugging around a computer undesirable. NOTE:
 - Each and every time your cellphone rings you will be marked absent.
 - If you are using your laptop or lab workstations to access material not relevant to class during class periods, you may be marked absent.
 - If you attempt to use your iPod or similar device during class you will be marked absent, unless I ask you to use such a device.

TENTATIVE COURSE SCHEDULE

(Changes/Updates will be posted on Blackboard)

PART 1 – INTRODUCTION TO GIS & GISCIENCE

Week 1. Introduction to the Course and GIScience

- Wednesday, August 25th: Syllabus, Course Policies, What is a GIS?
 - o Readings: Chapter 0 – Spatial Learner’s Permit {Finish By Today}
- Friday, August 27th: Activity – GIS in Everyday Life [QL-2, QL-3, FS-1, FS-3]¹
 - o Readings: Chapter 1 – Introduction to Digital Geography {Finish By Today}

Week 2. Maps and Spatial Concepts

- Monday, August 30th: Spatial Awareness, Spatial Distributions
 - o Readings: Chapter 2 – Basic Geographic Concepts
- Wednesday, September 1st: Collecting Geographic Data, Making Inferences from Samples
 - o Reading: Chapter 2 – Basic Geographic Concepts {Finish By Today} & Chapter 3 – Map Basics
- Friday, September 3rd: Activity – Making Decisions Using Geographic Data [QL-2, FS-1, FS-3, SAL-1]²
 - o Reading: Chapter 3 – Map Basics

Week 3. Round to Flat: Map Projections, Cartography, and ArcMap

- Monday, September 6th: **LABOR DAY HOLIDAY – NO CLASS OR READING**
- Wednesday, September 8th: Projections & Cartography
 - o Readings: Chapter 3 – Map Basics {Finish By Today}
- Friday, September 10th: Activity – ArcMap Demo³
 - o Readings: Chapter 4 – GIS Computer Structure Basics

¹ Students will explore simple GIS analysis through the use of Google Earth and other online mapping tools which represent geographic features in an interactive environment [QL-2] in order to answer questions such as how to determine the most efficient route from one city to another in the absence of roads, or selecting suitable sites for new-home development [QL-3]. This is an ungraded introductory exercise to get students used to the fact that they use geographic information systems in their daily lives and that such technologies can be readily used to answer specific questions [FS-1]. Because students will be asked to evaluate route-finding and site-suitability for an area of Indiana they are likely to be familiar with, they will have ample opportunity to apply their current knowledge to judge the performance of these online tools [FS-3].

² In this ungraded activity, students will answer an environmental question through the use of spatial and non-spatial data, comparing and contrasting the results they observe. The exercise will compare block-group level census data in tabular form and geographically, and students will be asked to articulate how the data differ in terms of the inferences that can be made from them, and also which counties might be the best location to establish a necessary dirty-industry (e.g., new coal electric plant) [QL-2, FS-3, SAL-1]. One important item that students will experience in this exercise is that it is difficult to make quick inferences about spatial distribution from a tabular dataset [FS-1].

³ A final ungraded activity will familiarize students with the software package many of the remaining lab activities will use.

Week 4. – Data Structures and Data Models – {GRADEABLE FRIDAY LAB ACTIVITIES BEGIN}

- Monday, September 13th: Computer Data Structure
 - o Readings: Chapter 4 – GIS Computer Structure Basics {Finish By Today}
- Wednesday, September 15th: GIS Data Models
 - o Readings: Chapter 5 – GIS Data Models
- Friday, September 17th: Lab 1 – Displaying and Querying Raster and Vector Data in ArcMap (20 Lab-Grade Points)[QL-1, QL- 2, QL-3, FS-1, FS-3, FS-7, SAL-2, SAL-3]⁴
 - o Readings: Chapter 5 – GIS Data Models {Finish By Today}

Week 5. GIS Data Input & Editing

- Monday, September 20th: Getting Spatial Data Into the Computer
 - o Reading: Chapter 6 – GIS Input {Finish By Today}
- Wednesday, September 22nd: Storing and Editing Spatial Data
 - o Reading: Chapter 7 – Data Storage and Editing
- Friday, September 24th: Lab 2 – Digitization and Editing (20 Lab-Grade Points)[QL-2, FS-3, SAL-2, SAL-3]⁵
 - o Reading: Chapter 7 – Data Storage and Editing {Finish By Today}
 - o Lab 1 Writeup Due by 11:59pm on Blackboard

PART 2 – GISCIENCE & SPATIAL ANALYSIS

Weeks 6 & 7. Queries, Measurement, Classification, and Surfaces

- Monday, September 27th: Locating, Identifying, and Querying Spatial Features in a GIS
 - o Reading: Chapter 8 – Query and Description
- Wednesday, October 29th: Simple Analysis Techniques: Length, Area, Shape, and Distance

⁴ Lab 1 write-up will be eligible for revision and regarding for writing-related issues [SAL-3]. Students will learn a number of important GIS skills by combining quantitative data about population and the environment to learn which environmental and social factors increase the odds of acquiring Malaria in Colombia [QL-1 for answering which environmental factors increase odds of malaria, QL-2 by employing spatial data to do so, QL-3 for employing distance-functions to answer certain questions]. While the activity will point students to the appropriate place to acquire data, they will have to combine it with data available from other (suggested) locations [FS-1], and will have to perform data processing and manipulation in order to use the data in a GIS analysis. This will help students develop the information literacy skills necessary to find appropriate data and put it into a format usable in the analytical environment they require [SAL-2]. Finally, students will be asked to discuss which social factors might make certain parts of Colombia more susceptible to this infectious disease [FS-3, FS-7].

⁵ Lab 2 write-up will be eligible for revision and regarding for writing-related issues [SAL-3]. This lab activity is primarily focused on teaching the skills necessary to take existing information and transform it into a spatially explicit digital form, a common data management and data creation task [SAL-2]. Students will have to use their knowledge of phenomena related to the social and physical environments of Central Indiana to decide how to most effectively and accurately digitize the data their instructor will provide, using the four primary spatial data dimensions (point, line, polygon, and raster field) in order to create a digital data set which will more accurately represent these phenomena in a GIS [QL-2, FS-3]. This skill set is vital in the professional and research realms.

- Reading: Chapter 8 – Query and Description {Finish By Today} & Chapter 9 – Measurement
- Friday, October 1st: Data Classification Techniques
 - Reading: Chapter 9 – Measurement {Finish By Today} & Chapter 10 – Classification
 - Lab 2 Writeup Due by 11:59pm on Blackboard
- Monday, October 4th: Surfaces and Interpolation Techniques
 - Reading: Chapter 10 – Classification {Finish By Today} & Chapter 11 – Statistical Surfaces
- Wednesday, October 6th: Lab 3 – Terrain Analysis: Slope, Aspect, and Viewsheds (80 Lab-Grade Points)[QL-1, QL2, QL-3, FS-1, FS-5, FS-8, SAL-1, SAL-3]⁶
 - Reading: Chapter 12 – Terrain Analysis
- Friday, October 8th: **FALL BREAK, NO CLASS OR READING**

Week 8. Terrain and Spatial Pattern Analysis

- Monday, October 11th: Terrain Analysis
 - Reading: Chapter 12 – Terrain Analysis {Finish **BEFORE** Class Today}
- Wednesday, October 13th: Measuring Spatial Patterns
 - Reading: Chapter 13 – Spatial Arrangement {Finish **BEFORE** Attempting Exam 1}
- Friday, October 15th: EXAM 1 (ON BLACKBOARD – NO CLASS MEETING)⁷

Week 9. Overlays and Cartographic Modeling

- Monday, October 18th: Overlay Analysis, Boolean Overlays
 - Reading: Chapter 14 – Map Overlay
 - Lab 3 Writeup Due by 11:59pm on Blackboard
- Wednesday, October 20th: Cartographic Modeling

⁶ Lab 3 write-up will be eligible for revision and regarding for writing-related issues [SAL-3]. Students will employ terrain analysis to evaluate the landscape impacts of environmental legislation meant to protect ridgelines in the Northeastern United States [QL-1 because students will determine which areas cannot be developed, QL-2 because students will employ a set of mathematical algorithms which take elevation and terrain into account to develop “viewsheds” which display what features can be seen from a given location, and QL-3 because these activities employ observation and experience (via computer displays) which illustrate how and why the viewshed algorithms function]. The reasons for protecting ridgelines will also be incorporated (a techniques course such as this one should always include content beyond tools, and this will introduce ethical implications of environmental decision-making , FS-1 & FS-8). A second case-study will employ similar methods to evaluate the surface-water contamination potential of EPA-Toxic Release Inventory sites in Vigo County, and will require students to recommend areas of the county which perhaps should not host these types of sites due to the potential for environmental and human-health damages [FS-5, FS-8]. This laboratory assignment will conclude by asking students to pick one of the two activities and develop a set of recommendations as to what could be done to minimize the negative impacts (to humans or environment) of their selected case-study by discussing the results of the laboratory assignment [SAL-1]. Because students will be required to download, process, and employ spatial data to complete this lab, they will develop and support their information literacy skills [SAL-2].

⁷ Exam 1 will assess the foundational GIS concepts and skills students have acquired through lectures, lab activities, and readings up to this point. The exam will likely consist of 20 multiple-choice questions, 5 short-answer questions, and 1 longer analytical question which will require students to detail the necessary data and analysis steps to answer a geographic question.

- Reading: Chapter 14 – Map Overlay {Finish By Today} & Chapter 15 – Cartographic Modeling
- Friday, October 22nd: Lab 4 – Answering Spatial Questions through Cartographic Modeling (100 Lab-Grade Points)[QL-1, QL-2, QL-3, QL-4, FS-1, FS-2, FS-3, SAL-1, SAL-2]⁸
 - Reading: Assigned Reading (Check Blackboard) {Finish **BEFORE** Class Today} & Chapter 15 – Cartographic Modeling

Week 10. GIS Database Design

- Monday, October 25th: Organizing Your Data Around a Project
 - Reading: Chapter 15 – Cartographic Modeling {Finish By Today} & Chapter 17 – GIS Design
- Wednesday, October 27th: Database & Data Model Considerations
 - Reading: Chapter 17 – GIS Design
 - ONLINE QUIZ 1: 50 POINTS (ON BLACKBOARD, in addition to class meeting)⁹
- Friday, October 29th: GIS in Institutions
 - Reading: Chapter 17 – GIS Design {Finish By Today}
 - Lab 4 Writeup Due by 11:59pm on Blackboard

PART 3 – GIS PROJECTS¹⁰

Week 11. Cartographic Design

- Monday, November 1st: Cartographic Considerations
 - Reading: Chapter 16 – Cartography and Visualization
 - Project Proposal Due by 11:59pm on Blackboard
- Wednesday, November 3rd: Scale - Global and Local Data
 - Reading: Reading TBA (CHECK BLACKBOARD)

⁸ Students will be asked to use library resources to locate and read a specific sample study drawn from the GIS literature before coming to class [FS-1]. They will then be asked to replicate the study by diagramming the analysis steps that would be necessary to replicate the study, which requires students to think through the analysis steps before undertaking them [QL-1]. Students will then perform the analysis, and then reflect on what improvements could be made to better the study [FS-3]. They will be asked to judge which data could improve the analysis and if research design played a role in the analysis outcome [FS-2, QL-4]. The study and data will be selected so that there are a number of analysis step and research design improvements which would significantly better the study and potentially change analysis outcomes [QL-4, FS-2, SAL-2, SAL-3]. Students will learn how the analysis process is actually undertaken, that pre-planning can expose holes in data or analysis design, and that these holes or shortcomings can have a significant impact on a study's results [QL-2, SAL-1].

⁹ Quiz 1 will consist of 5 multiple-choice questions and 2 short-answer questions assessing the mastery of the more advanced conceptual foundations and analytical techniques covered in the period since exam 1. Specifically, it will ensure that students know when to apply overlay analysis, how to complete and employ a cartographic model, and that they are aware of data problems and database considerations specific to GIS.

¹⁰ For the rest of the semester the emphasis of lab exercises will be on completing final poster project goals rather than acquiring foundational GIS skills. However, many of the lab activities along the way will incrementally build student's GIS toolsets so that by the conclusion of the class they will have the basic skills needed to undertake GIS projects independently.

- Friday, November 5th: Lab 5 – Acquiring Data Online (50 Lab-Grade Points)[QL-1, QL-3, FS-1, SAL-2]¹¹
 - o Project Groups Formalized

Week 12. Recording Your Work and Picking an Appropriate Analytical Workflow

- Monday, November 8th: Metadata & Recording Analysis Steps
 - o Reading: Federal Geospatial Metadata Factsheet at <http://www.fgdc.gov/library/factsheets/documents/metafact.pdf>
- Wednesday, November 10th: Data Type Conversions & Data Loss
 - o ONLINE QUIZ 2: 50 POINTS (ON BLACKBOARD, in addition to class meeting)¹²
- Friday, November 12th: Lab 6 – Choosing and Employing Appropriate Analytical Techniques (100 Lab-Grade Points)[QL-2, QL-3, QL-4, FS-1, FS-2, FS-10]¹³
 - o Reading: Clarke, Keith. 2003. GIS in Action. (Available on Blackboard)
 - o Lab 5 Writeup Due by 11:59pm on Blackboard

Week 13. Evaluating GIScience

- Monday, November 22nd: Evaluating GIScience
 - o Reading: Goodchild, M. (2004) GIScience, geography, form, and process. *Annals of the Association of American Geographers*, 94, 709-714. (Available via the ISU Library) {Finish By Today}
- Wednesday, November 24th: **HOLIDAY BREAK, NO CLASSES OR READING**
- Friday, November 26th: **HOLIDAY BREAK, NO CLASSES OR READING**

Week 14. GIS and Multiple Data Sources, Presenting GIS Results

- Monday, November 29th: Integrating GIS & Remote Sensing
 - o Reading: Walsh et al. 2003. Integration of longitudinal surveys, remote sensing time series, and spatial analyses. In: *People and the Environment: Approaches*

¹¹ Students will locate available data on a wide variety of websites, and will be asked to tailor their searches to fit their project, which would have been proposed earlier in the week [QL-2, SAL-2]. They will be asked to locate data to fit other potential projects as well, with the idea of training them to think critically about why they require data and how to go about finding it [FS-1, SAL-1, SAL-2]. They will be asked to compare data from sources with different levels of reliability as well, with the idea that some geographic (and non-geographic) data sources are highly reliable and respected, while others are not [SAL-1, SAL-2]. The focus of this data reliability test will involve comparing results of a simple analytical tool and assessing which dataset provides better results [QL-3].

¹² Quiz 2 will consist of 5 multiple-choice questions and 2 short-answer questions assessing the mastery of the more advanced conceptual foundations and analytical techniques covered in the period since quiz 1. Specifically, it will ask students to take stock of the sorts of institutions which employ GIS technologies, and how they do so. The quiz will also require students to articulate why adequate metadata is necessary *and* why it saves analysis time in the long-run. Finally, students will be asked to clearly articulate why data transformations should be avoided in most instances.

¹³ Working in small groups students will diagram and discuss their proposed analytical steps to answer a given a set of questions focusing on income in Vigo County [QL-2, QL-3, FS-1, FS-10]. They will then have to complete analysis in order to answer one of these questions (using data provided by the instructor) and brainstorm other analytical methods which may have provided a similar answer (questions will be selected so that multiple analytical pathways will be possible). Students will then have to provide their solutions and steps to others in the class for peer evaluation (though grading will be the responsibility of the instructor) [FS-2, QL-4]. The intent is to allow students to observe that GIS can be employed in different ways to get to the same, or similar, result.

for Linking Household and Community Surveys to Remote Sensing and GIS, 91-129. (Available on Blackboard)

- Wednesday, December 1st: Lab 7 – GIS Data Presentation & Poster Design (30 Lab-Grade Points)[QL-2, QL-3, FS-3, FS-4, FS-10, SAL-2]¹⁴
 - o Reading: Tufte, E. R. 1983. Graphical Excellence. In *The Visual Display of Quantitative Information*, 13-51. Cheshire, CT: Graphics Press. (Available on Blackboard)
 - o Lab 6 Writeup Due by 11:59pm on Blackboard
- Friday, December 3rd: Linking Addresses to Place: Geocoding
 - o ONLINE QUIZ 3: 50 POINTS (ON BLACKBOARD, in addition to class meeting)¹⁵

Week 15. STUDY WEEK – Classes proceed as normal – “Mystery” Data, Privacy, and Poster Workshop.

- Monday, December 6th: What to do With Mystery Data
 - o Lab 7 Gradeable: Draft Poster due IN CLASS, feedback available in 24hours [SAL-3]¹⁶
- Wednesday, December 8th: GIS & Privacy
 - o Reading: Armstrong, M. & A. Ruggles (2005) Geographic information technologies and personal privacy. *Cartographica: The International Journal for Geographic Information and Geovisualization*, 40, 63-73. (Available on Blackboard)
- Friday, December 10th: Poster Troubleshooting & Final Touches **LAST DAY OF CLASS**

¹⁴ Students will be guided through the steps necessary to represent GIS analysis results professionally in the form a poster [QL-2 because individual projects will require that students meet the items described in the learning goal, QL-3, FS-3 because students will be required to employ/develop expertise on their problem of study, FS-10 because students will work in groups to develop a visual and verbal communication tool – a poster]. FS-4 will be addressed through the application of the reading (exquisitely illustrated with many historical examples of information-bearing graphics) concepts for that day to the task at hand: learning to create a coherent and informing display of both figures and text that delivers the results of an analysis to an audience of GIS and non-GIS students, faculty, and staff [SAL-2, FS-10].

¹⁵ Quiz 3 will consist of 5 multiple-choice questions and 2 short-answer questions assessing the mastery of the more advanced conceptual foundations and analytical techniques covered in the period since quiz 2. This quiz will require students to differentiate between GIS, which is an analytical toolkit, and GIScience, which is a framework for investigating scientific questions. The quiz will also require students to describe some graphic design considerations unique to mapping and spatial data, and will assess student knowledge of geocoding and the integration of remotely sensed data in GIS analysis.

¹⁶ Students will submit a draft before the final poster will be printed and graded. Instructor comments on visual design, content, and writing will be returned within 24 hours for final correction before printing [SAL-3].

Week 16. FINALS WEEK.

- Wednesday, December 15th: Poster Presentation Session, 9:00 – 9:50am. [QL-1, QL-2, QL-3, QL-4, SAL-2, SAL-3]¹⁷
 - *Normal office hours will be in effect for this entire week unless I notify the class otherwise. If normal office hours are modified I will still be available by appointment and at posted alternate times.*
 - *NOTE: Students, Faculty, and Staff in the Geology, Geography, and Anthropology department, and other ISU community members will be invited to view student posters during the poster presentation session.*

¹⁷ The poster will be a culminating presentation [FS-10] of a relatively complex independent project and analysis [QL-1, QL-2, QL-3, FS-1, FS-3, SAL-2] and will involve writing and presentation skills [FS-10, SAL-3], and incorporate the student-evaluation of all poster projects [QL-4, FS-2].