# GEOGRAPHY & GEOINFORMATION SCIENCE 311
# INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEMS

## 1. INSTRUCTORS

**Instructor:** Dr. Matt Rice
**Term:** Fall 2018
**Class Day/Time:** GGS 311-002, Mondays and Wednesdays, 1:30pm-2:45pm (CRN 71653)
**Class Location:** GMU Exploratory Hall, Room 2103
**Faculty Office:** GMU Exploratory Hall, Room 2202
**Faculty Office Hours:** Monday & Wednesday 3:00-4:00pm
**Instructor Email:** rice@gmu.edu  subject=[GGS 311]

**Teaching Assistant:** Palak Matta
**Teaching Assistant Email:** pmatta@masonlive.gmu.edu
**Teaching Assistant Office Hours:** *TBD*

**Learning Assistants:**     Richard McGown (rmcgown@masonlive.gmu.edu)
                             Jason Oakley (joakley2@masonlive.gmu.edu)
**Learning Assistant Office Hours:** *TBD*

I can be reached via email to arrange alternate office hours. I may not be able to read and answer your email immediately, particularly on evenings or weekends, but I will do my best to be available, provide help, and answer questions quickly, usually within 24 hours. Students must activate and use their GMU campus email to facilitate contact. **I cannot communicate with you through a non-GMU email.** Please use a subject line prefix tag: [GGS 311]. **Send general GIS and troubleshooting questions to the TA or LAs first**. If the question or concern is administrative, contact me first.

## 2. COURSE DESCRIPTION

This course is designed as an introduction to geographic information systems and focuses on the associated fundamental scientific principles, theories, and techniques. Students will learn how the Earth's features are modeled and stored in a computer information system. Students will learn how to use geographic information systems to answer geographic questions and how to perform simple analytical procedures using geographic data. Students will formulate a research proposal around a scientific question, adopt appropriate GIS-based methodology, collect geographic data, conduct analysis, and prepare a summary and evaluation of findings.
**Credit Hours for this course: 3**

# 3. COURSE PREREQUISITES

There are no formal prerequisites. Some students may find GGS 110 (Maps and Mapping) useful. In the future, it may be a prerequisite to this course.

# 4. COURSE EXPECTATIONS

1. Upper division courses require dedication and organization. Proper preparation is expected every week. You are expected to stay informed, attend class, and complete the assignments and activities on or before the due dates.
2. Students must check their GMU email messages on a daily basis for course announcements, which may include reminders, revisions, and updates.
3. It is expected that you will familiarize yourself with and adhere to the Honor Code. Student members of the George Mason University community pledge not to cheat, plagiarize, steal, and/or lie in matters related to academic work.
4. Complete work on time and discuss instructor and TA evaluations to resolve questions.
5. It is essential to communicate any questions or problems to me promptly.

# 5. LEARNING COMMUNITY

This course is taught face-to-face, but some course content may also be delivered via Blackboard Courses (Log into http://mymason.gmu.edu, select the Courses Tab, and the course can be found in the Course List).

Student can be assisted periodically through Blackboard Collaborate sessions where GIS software is demonstrated. **In order to participate in Blackboard Collaborate, you must be at a computer with a microphone** and optionally, a video camera.

In online interactions, we must be respectful of one another. Please be aware that innocent remarks can be easily misconstrued. Sarcasm and humor can be easily taken out of context. When communicating, please be positive and diplomatic.

# 6. LEARNING OUTCOMES

By the end of this course, students will be able to:
1. Demonstrate a broad knowledge-base of the fundamental scientific theories, principals and techniques of Geographic Information Systems.
2. Demonstrate an understanding of the societal context of GIS, and articulate important historical events, contemporary developments, and future trends that shape GIS.
3. Apply and demonstrate key concepts of spatial analysis using commercial GIS software.
4. Given a specific problem, identify problem parameters, characterize data needs, assemble data, and perform analysis with GIS.
5. Effectively communicate results of research and analysis using maps and graphics produced with GIS, created according to best professional cartographic practices and aesthetic guidelines.

# 7. TECHNOLOGY REQUIREMENTS & EXPECTATIONS

## General Hardware:
To complete this class and use Blackboard effectively, you will need access to a Windows or Macintosh computer with at least 4 GB of RAM and to a fast and reliable broadband Internet connection (e.g., cable, DSL). A larger screen is recommended for better visibility of course material. You will need speakers or headphones to hear recorded content and a headset with a microphone is recommended for the best experience. For the amount of Hard Disk Space required to take a course such as this, consider and allow for: **1.** The storage amount needed to install any additional software and **2.** Space to store work that you will do for the course. If you are considering the purchase of a new computer, please go to http://patriottech.gmu.edu/ to see recommendations. Review detailed hardware minimum specifications provided by Esri, the vendor of the GIS software we use for this course.

## Software:
This course uses Blackboard as the learning management system. You will need a browser and operating system that are listed compatible or certified with the Blackboard version available on the myMason Portal. See supported browsers. Log in to myMason to access your registered courses. Some courses may use other learning management systems. Check the syllabus or contact the instructor for details. Online courses typically use Acrobat Reader, Java (Windows), and QuickTime. Your computer should be capable of running current versions of those applications. Also, make sure your computer is protected from viruses by downloading the latest version of Symantec Endpoint Protection/Anti-Virus software for free at http://antivirus.gmu.edu.

Students owning Macs or owning computer running Linux should be aware that some courses may use software that only runs on Windows, including the primary software tool for this class, ArcGIS 10.5.1 for Desktop. You can set up a Mac computer with Boot Camp or virtualization software so Windows will also run on it. This following webpage https://support.apple.com/en-us/HT201468 ) contains information about using Windows on a Mac in bootcamp mode. It is also possible to run Windows using a virtual machine on your Mac.  Search "running windows on my Mac".  Computers running Linux can also be configured with virtualization software or configured to dual boot with Windows.. Setting up Windows on your Mac can be a bit complicated, and will require some technical support, which may be provided through GMU Patriot Tech.

**Note:** If you are using an employer-provided computer or corporate office for class attendance, please verify with your systems administrators that you will be able to install the necessary applications and that system or corporate firewalls do not block access to any sites or media types.
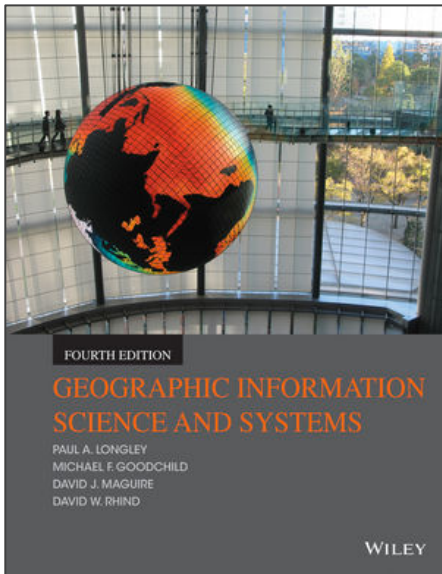
## GGS 311: Geographic Information Systems Software

**PLEASE READ CAREFULLY:** You will need to be able to use a computer to participate in this course and complete the required work. You will not be required to purchase GIS software, but will have a one year student evaluation version of **ArcGIS Desktop Advanced version 10.5.1** provided for you through a software download link.  Although access to this GIS software is provided through computer labs all over campus, you may choose to install and use the student GIS software on your own computer. This will require administrator-level access and control of a **Windows PC computer**. If you have convenient, frequent access to any computer with ESRI's ArcGIS 10.5.1 installed and running, you may be able to this computer for the GIS exercises and will not need to do the software install.
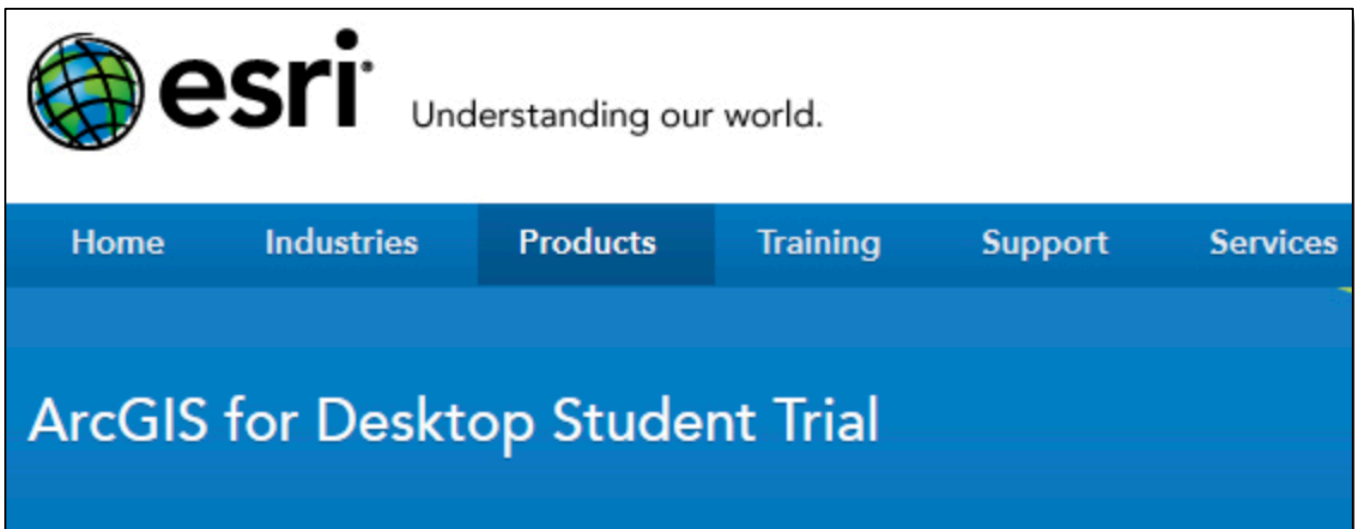


## 8. TEXTS & MATERIALS (required)

Textbooks must be purchased and available prior to the first day of class.  The textbook is widely available from a number of sources as a new book, as a used book, and as a rental.  Both books are required.  The first book (Longley et al., "Geographic Information Science and Systems", 4th edition) is a traditional textbook that will be used for lectures and exams.  The second book (Price, "Mastering ArcGIS", 8th edition) is a GIS workbook with tutorials and exercises that will be due each week.

## Geographic Information Science and Systems, 4th Edition

Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind

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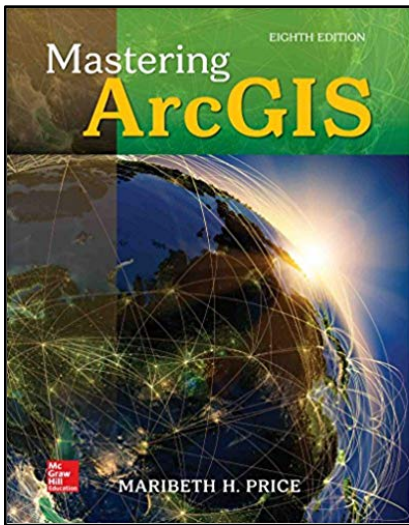**Limited Chapter versions of this text book exist and may be used with caution.  The limited chapter versions need to be the 4th edition with the following original chapter numbers:  1, 3, 4, 5, 6, 7, 8, 11, 12**

**Mastering ArcGIS, 8th Edition**

By Maribeth Price

Copyright: 2019

Publication Date: January 30, 2018
**ISBN-13:** 978-1-259-92965-6
**ISBN-10:** 1-259-92965-5

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## Data Storage

Each student must have a USB flash drive or disk space to store around 2 Gb of data files that we will use for some of the computer exercises. USB Flash drives are available at Patriot Computer, Best Buy, Target, etc. . .

# 9. PERFORMANCE-BASED ASSESSMENTS

You will achieve the course learning outcomes **(Section 4)** through reading the textbook, attending and participating in the course lectures, participating in class discussions, working through GIS tutorials, completing lab exercises, completing a comprehensive course project, and taking an assessment exam at midterm and during finals week at the designated finals time.

**a. GIS Exercises**: There will be 10 separate GIS tutorials and exercises, assigned from the Price, "Mastering ArcGIS" textbook, and due as indicated on the Course Schedule. Each GIS Exercise begins with a tutorial, which **must be completed prior to completion of the exercises**. Completion of the assigned weekly tutorial and the assigned GIS exercises are required, with submissions taking the form of maps, graphics, tables, statistics, written comments, and answers to the assigned exercises. Late GIS exercise submissions (those submitted after the deadline) will be penalized 10% for each day they are late, and will not be graded after the 10th day. The 10 assigned GIS Exercises are cumulatively worth **40%** of the final grade.

**b. Examinations:** There will be 2 examinations, which must be completed in the prescribed time period. These examinations will cover the Longley et al. textbook readings. The exams will include multiple choice questions, definitions, diagram labeling, and short answer questions. The two exams will be worth 20% each and cumulatively worth **40%** of the final grade.

**c. Final Course Project:** GGS 311 has been designed to meet the requirements of a GMU research intensive course, and is an integral part of the research intensive GIS minor. Each student will complete a final course project, consisting of a scientific research proposal, geographic data collection, GIS-based analysis, summary, and presentation. The course project will build on the underlying scientific knowledge gained in the course and the GIS skills acquired through the lab exercises. The project will include a video presentation that will be prepared by the student and uploaded to blackboard along with relevant text, charts, graphics, and maps. The final project will be worth **20%** of the final grade.

# 10. GRADING SUMMARY

Students will be evaluated in the following areas, with the following grade weighting:

GIS Exercises (40%)
Examinations (40%)
Final Course Project (20%)

Grades are assigned using a standard scale:

| | |
|---|---|
| A+ | > 99 |
| A | 93 – 98.9 |
| A- | 90 – 92.9 |
| B+ | 87 – 89.9 |
| B | 83 – 86.9 |
| B- | 80 – 82.9 |
| C+ | 77 – 79.9 |
| C | 73 – 76.9 |
| C- | 70 – 72.9 |
| D | 60 – 69.9 |
| F | 0 – 59.9 |

# 11. RUBRICS

**GIS Exercises**

Each GIS Exercise will be worth 20 points, with 1 point for each substantive answer indicated in the assigned problem set, or other significant methodological step. With regard to numerical answers, a complete answer with the relevant units will be worth full credit for that problem. Students start with 20 points and receive a 1 point deduction for incorrect answers or incorrect execution of a method, and a ½ point deduction for minor errors such as a lack of units where required. Incorrect or incomplete answers not including an omission of units (ft., yards, acres, miles, meters, etc.) will receive a full point deduction. GIS Exercises will have a full written evaluation and specific indicators of reasons for point deductions. GIS Exercises should be submitted through Blackboard in Microsoft Word format or other relevant format as specified in the assignment. Cartographic work must be submitted in PDF format in highest quality, and according to standard cartographic conventions.

**Course Project**

Each course project will be worth 100 points, and graded according to the rubric below. Students are expected to work in very small groups (2 students) and will received a single grade for their finished presentation, which will be uploaded to blackboard and viewed by the class.

| Course Project Grading Rubric | | | | |
|---|---|---|---|---|
| **Criteria** | **Outstanding** | **Good** | **Fair** | **Poor** |
| **Organization** | Course projects consist of 1) a short introduction with a relevant problem statement, 2) a description of data collected to address the problem, 3) a presentation of the GIS-based analysis, 4) a short synopsis, and 5) relevant textual descriptions, tables, charts, and maps | The course project is missing only one of the numbered sections, and has minor organizational errors | The course project is missing two numbered sections and has multiple organizational problems | The course project lacks coherent organization and structure and is missing multiple identifiable content sections. |
| **Length** | 5 minutes recorded length | Minor length deviation (<10%) | Major length deviation (20%-40%) | Length does not adhere or approach length requirements (> 40% deviation) |
| **Syntax/Format** | Correct grammar and syntax for textual material, and correct cartographic best practices, correct presentation format and specifications | Minor syntax, grammar, and spelling errors in textual content, minor cartographic errors in maps, minor presentation format or deficiencies | Multiple syntax, grammar, and spelling errors throughout course project, multiple cartographic errors, and deficiencies in presentation format | Course project is replete with syntax, grammar, and spelling errors and map lacks any cartographic best practices, presentation format is incorrect. |
| **Research and Content** | The course project includes relevant data that addresses the research problem, uses GIS-based analysis from labs, and extends all material through a well-presented synthesis | The course project contains relevant data and GIS-based analysis, with minor deficiencies, omissions, or irrelevant content | The data collected and GIS-based analysis only partially relate to the problem statement and contain much irrelevant content and major deficiencies | The course project does not address a problem statement, does not use relevant data, and has major deficiencies in the GIS-based analysis used. |
| **Points** | 90-100 | 75-90 | 50-75 | 50 or less |

**Exams**

Exams will be conducted and graded on Blackboard and will consist of multiple choice, true/false, fill-in-the-blank, short answer, and essay questions. The exams will be graded automatically after completion, for all questions except short answer and essay questions, which will be graded by the instructor or TA. Incorrect responses will be marked with a reference to the textbook section and lecture # with the information required for a correct response. The Instructor or TA will provide written feedback for short answer and essay questions. Each exam will be worth a total of 50-70 points, depending on configuration, and will converted to a percentile (%), and scaled to a 20% grade contribution. Together, the exams will comprise 40% of the final grade.

# 12. STUDENT EXPECTATIONS

## Academic Integrity

It is expected that students adhere to the [George Mason University Honor Code](#) as it relates to integrity regarding coursework and grades.  The Honor Code reads as follows:

> *"To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this: Student members of the George Mason University community pledge not to cheat, plagiarize, steal and/or lie in matters related to academic work."*

More information about the Honor Code, including definitions of cheating, lying, and plagiarism, can be found at the Office of Academic Integrity website at [https://oai.gmu.edu](https://oai.gmu.edu)

Discussion of work among students is encouraged. Collaboration and active participation in group discussions is important, but final work should reflect your own thinking and all submitted assignments **must be in your own words and reflect your individual work**.  I reserve the right to use GMU-sanctioned tools for detecting and documenting plagiarism.  If you have questions about what constitutes plagiarism, please ask me.

## MasonLive/Email (GMU Email)
Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account. [See [http://masonlive.gmu.edu/](http://masonlive.gmu.edu/)]

## Patriot Pass
Once you sign up for your Patriot Pass, your passwords will be synchronized, and you will use your Patriot Pass username and password to log in to the following systems: Blackboard, University Libraries, MasonLive, myMason, Patriot Web, Virtual Computing Lab, and WEMS. [See [https://password.gmu.edu/index.jsp](https://password.gmu.edu/index.jsp)].

## University Policies
Students must follow the university policies. [See [http://universitypolicy.gmu.edu](http://universitypolicy.gmu.edu)].

**Responsible Use of Computing**
Students must follow the university policy for Responsible Use of Computing. [See
http://universitypolicy.gmu.edu/policies/responsible-use-of-computing].

## 13. DIVERSITY

Diversity is an important in an academic environment, and is a priority for George Mason University.   See:
http://ctfe.gmu.edu/professional-development/mason-diversity-statement/

*"George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth. An emphasis upon diversity and inclusion throughout the campus community is essential to achieve these goals. Diversity is broadly defined to include such characteristics as, but not limited to, race, ethnicity, gender, religion, age, disability, and sexual orientation. Diversity also entails different viewpoints, philosophies, and perspectives. Attention to these aspects of diversity will help promote a culture of inclusion and belonging, and an environment where diverse opinions, backgrounds and practices have the opportunity to be voiced, heard and respected."*

## 14. RELIGIOUS HOLIDAYS

I am generally aware of some religious holidays and observations, and will help minimize difficulties for students of different faiths in terms of scheduling course assignments. It is the student's responsibility to speak to me in advance should their religious observances impact their participation in class activities and assignments.  [See: http://ulife.gmu.edu/calendar/religious-holiday-calendar/ ]

## 15. SPECIAL NEEDS

If you have a documented learning disability or other condition that may affect academic performance you should: **1**) make sure this documentation is on file with the Office of Disability Services (SUB I, Rm. 2500; 993-2474; http://ds.gmu.edu/) so that they can make a determination about the accommodations you need; and **2**) communicate with me to discuss your accommodation needs or have the Office of Disability Services do so.  I can provide proper accommodations with documentation and professional advice from the Office of Disability Services.

## 16. STUDENT SERVICES AND UNIVERSITY RESOURCES

**University Libraries**
The George Mason University Libraries provides resources for distance education students.  For access to these resouces and services, see http://library.gmu.edu/for/online .

**Writing Center**
The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing. [See http://writingcenter.gmu.edu]. You can now sign up for writing assistance

through the Office of Digital Learning's Online Writing Center [see http://odl.gmu.edu/resources/writing-center/ ]

## Counseling and Psychological Services

The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See http://caps.gmu.edu].

## Family Educational Rights and Privacy Act (FERPA)

The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights. [See http://registrar.gmu.edu/ferpa/ ].

## 17. TENTATIVE COURSE SCHEDULE (subject to change)

You are responsible for keeping up with the textbook readings, lectures, GIS tutorials/exercises, project deliverables, and assessments. No makeup exams will be available. Readings assigned for the week & session should be completed before the scheduled date. **Any changes to this schedule will be announced in class and posted to the course Blackboard page.**

| Week & Date | Topic | Readings (Longley et al) | GIS Topics, Tutorials & Exercises \| Due Date | Project \| Due Date |
|---|---|---|---|---|
| *< August 27th* | *Review syllabus, purchase textbooks* | | | |
| **Aug. 27th, 29th** | Introduction/Overview | 1.1-1.7 pp.1-32 | *Install ArcGIS Student Evaluation Software, Prepare Maribeth Price data for use* \| **Sep. 3rd** | |
| **Sep. 3rd** | *Labor Day, GMU is closed* | | | |
| **Sep. 5th** | GIS Overview, History | 1.1-1.7 pp.1-32 | Price Chapter 1: GIS Data, pp.9-42, #1-6 on p.42 \| **Sep. 7th, 5:00pm** | |
| **Sep. 10th, 12th** | GIS Software | 6.1-6.7 pp.128-151 | Price Chapter 2: Managing GIS Data, pp.43-72, #1-4 on p.72 \| **Sep. 21st, 5:00pm** | Project Introduction (nothing due) |
| **Sep. 17th, 19th** | Georeferencing | 4.1-4.13 pp.77-98 | Price Chapter 2: Managing GIS Data, pp.43-72, #1-4 on p.72 \| **Sep. 21st, 5:00pm** | |
| **Sep. 24th, 26th** | Georeferencing | 4.1-4.13 pp.77-98 | Price Chapter 3: Coordinate Systems, pp.73-106, #1-3 on p.106 \| **Sep. 28th, 5:00pm** | |
| **Oct. 1st, 3rd** | Representing Geography | 3.1-3.9 pp.55-76 | Price Chapter 4: Mapping GIS Data, pp.107-138, #1-5 on p.138 \| **Oct. 5th, 5:00pm** | Project Pre-proposal \| **Oct. 7th** |
| **Oct. 8th** | *Fall Break,* **Monday classes meet on Tuesday the 9th** | | | |
| **Oct. 9th, 10th** | Data Collection & Data Capture | 8.1-8.7 pp.173-193 | Price Chapter 5: Presenting GIS Data, pp.139-172, #1 on p.172 \| **Oct. 12th, 5:00pm** | |
| **Oct. 15th, 17th** | Data Collection & Data Capture, Exam Review | 8.1-8.7 pp.173-193 | Price Chapter 6: Attribute Data, pp.173-204 #2-6 on p.204 \| **Oct. 19th, 5:00pm** | Project Proposal \| **Oct. 21st** |
| **Oct. 22rd, 24th** | **MIDTERM EXAM (IN CLASS)** | | | |
| **Oct. 29th, 31st** | Geographic Data Modeling | 7.1-7.4 pp.152-172 | Price Chapter 7: Basic Editing, pp.205-230 #6-7 on p.230 \| **Nov. 2nd, 5:00pm** | |
| **Nov. 5th, 7th** | Cartography & Geovisualization | 11.1-12.5 pp.237-289 | Price Chapter 8: Queries, pp.231-258 #1-6 on p.258 \| **Nov. 9th, 5:00pm** | Project Data Check \| **Nov. 11th** |
| **Nov. 12th, 14th** | Uncertainty | 5.1-5.5 pp.99-127 | Price Chapter 9: Spatial Joins, pp.259-288, #1-4 on p.288 \| **Nov. 16th, 5:00pm** | |
| **Nov. 14th** | **GIS Day** (attend for extra credit) | | | |
| **Nov. 19th** | Uncertainty | 5.1-5.5 pp.99-127 | Price Chapter 10: Map Overlay and Geoprocessing, pp.289-317, #1,2,6,7 on p.317 \| **Nov. 30st, 5:00pm** | Project Map Check \| **Dec. 2nd** |
| **Nov. 21st - 25th** | *Thanksgiving Holiday* | | | |
| **Nov. 26th, Nov. 28th** | The GeoWeb | 10.1-10.5 pp.217-236 | Final project work sessions, map & video help | |
| **Dec. 3rd, 5th** | Projects + Exam Review | Final Project Work Session (3rd), Final Exam Review (5th) | | Final Project Due \| **Dec. 9th** |
| **FINAL EXAM:  Wednesday, Dec. 12th, 1:30pm-4:15pm, Exploratory Hall, Room 2103** | | | | |

**\*\* NOTE:** Any changes to this syllabus will be announced via email and posted on blackboard. For a general university schedule and calendar, see:
https://registrar.gmu.edu/calendars/fall-2018/