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**Hours:** Th 4:30 PM – 7:10 PM  
**Location:** EXPL 2310  
**Website:** <https://mymason.gmu.edu>  
**Sect/Credits:** 001 / 3 credit hours

**Instructor:** Nathan Burtch  
**Email:** [nburtch@gmu.edu](mailto:nburtch@gmu.edu)  
**Instructor office:** EXPL 2413  
**Office hours:** TuWe 3:00 – 5:00 PM

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## General Information

### Classmate contact information:

Name	Email	Phone

**Catalog description:** Sources of digital geospatial data; and methods of input, storage, display, and processing of spatial data for geographic analysis using GIS. Lectures, hands-on exercises familiarize students with current technology.

**Course overview:** Geographic Information Systems (GIS) are computerized systems designed for the storage, retrieval and analysis of geographically referenced data. GIS uses advanced analytical tools to explore at a scientific level the spatial relationships, patterns, and processes of cultural, biological, demographic, economic, geographic, and physical phenomena. This is done through modeling the infinite complexity of the Earth to finite computer systems. By the end of the course, students will have sufficient background to identify spatial characteristics of diverse application areas enabling them to integrate spatial thinking and GIS analysis into their academic research and careers.

In this graduate level course, students will learn GIS history, theory, and methods through readings and lectures. Through lab assignments and a term project, students will apply these principles in 'hands-on' experience with real world datasets, using the software package ArcGIS.

**Target audience:** This course is required for those pursuing the Geographic and Cartographic Sciences MS, the Geoinformatics and Geospatial Intelligence MS, the Accelerated MS degrees offered by GGS, and both the Geospatial Intelligence and the Geographic Information Science graduate certificates. It is an optional core class for those pursuing the Earth Systems and Geoinformation Sciences PhD, the Earth Systems Science MS, or the Environmental GIS and Biodiversity Conservation graduate certificate. Beyond those programs, this course is also targeted for students within other graduate programs who want to learn the fundamentals of GIS and develop geoinformation analysis.

**Applicable learning outcomes:** Successful completion of this course will enable students to:

1. Define key concepts and principles related to the fundamental scientific theories and techniques of GIS.
2. Demonstrate skills of data creation, management, and analysis using commercial GIS software.

3. Develop graduate-level independent research in spatial analysis by acquiring and processing GIS data.
4. Effectively communicate by coupling analysis with visual outputs in the form of maps and other graphics produced with GIS, designed according to best professional cartographic practices and aesthetic principles.
5. Develop skills involved in problem solving with spatial data and methods.

**Prerequisites:** It is recommended that students take GGS 550 or equivalent, or receive permission of the instructor.

**Enrollment and repeat policy:** This may not be repeated for credit. Enrollment is limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree, or Senior Plus. Students in a Non-Degree Undergraduate classification may not enroll.

## Course Materials

### Required texts:

#### *Textbook:*

Bolstad, Paul (2016). *GIS fundamentals: A first text on geographic information systems*. 5<sup>th</sup> ed. Eider Press, White Bear Lake, MN.  
ISBN: 9781506695877.

The 5<sup>th</sup> edition is the newest edition of this text. This text has been chosen because it is affordable and comprehensive. You may also purchase older editions of the text; there will be some differences but overall covers the same topics. The 5<sup>th</sup> edition can be purchased as either a physical book or an eBook. The text is available in the campus bookstore. Go to [http://www.xanadu.com/higher-education/educators/custom-books-catalog/gis\\_fund\\_5e/](http://www.xanadu.com/higher-education/educators/custom-books-catalog/gis_fund_5e/) to purchase the text from the publisher directly. You can also find copies available on Amazon for purchase, and probably at other online retailers.

#### *Lab manual:*

Law and Collins (2018). *Getting to know ArcGIS Desktop*. 5<sup>th</sup> ed. ESRI Press.  
ISBN: 9781589485105.

**DO NOT** get any older editions of the lab manual; it may not have instructions that are fully compatible with our labs and assignments. This text is available in the campus bookstore. You can purchase the lab manual from a variety of online retailers. If you purchase a new copy, you will receive a code for an evaluation copy of our course software, ArcGIS. Chances are used books will not have a valid code. If you are buying an eBook, Esri provides information on how to get an evaluation software copy and sample data. This information is at <http://esripress.esri.com/display/index.cfm?fuseaction=display&moduleID=0&websiteID=286>.

**Software, hardware, and data:** We will use Esri ArcGIS for lab work this semester. You are able to download a 180-day trial when a new Law and Collins lab manual is purchased. **This software is NOT compatible with the Macintosh operating system (Apple computers). You must have Microsoft Windows installed.** For Mac users, you can install Windows concurrently with your existing operating system. See here: <http://support.apple.com/kb/HT1461>.

For labs, you **MUST** have a **data storage device that can hold all of the data** necessary for labs, along with your own lab documents and project. Many of the files we will use are very large! If you intend to only use your personal computer for labs, this can be the internal hard drive. If you plan on using multiple computers (ie: desktop and laptop, home and GGS labs, etc.), you **must** put all lab data on a portable storage device, such as a USB stick or external hard drive. Again, make sure it is large enough to hold all the GIS data. 16 GB of storage or more is preferable. Cloud storage is another option, either to keep all your files or to use as a common backup.

The lab in EXPL 2102 is open 24 hours for you to use. Registration in a GGS class should automatically grant you access. Please contact [ggsit@gmu.edu](mailto:ggsit@gmu.edu) to report issues. You can also make use of the GMU Virtual Computing Lab (<https://www.vcl.gmu.edu/>).

**Online materials and email:** This course will make extensive use of Blackboard at Mason. Course materials such as assignments will be available only in electronic version on Blackboard. Also, students will be expected to submit assignments online through Blackboard. **Only Word document (.docx or .doc) or Adobe PDF (.pdf) file formats will be accepted**, with some exceptions. Grades will be posted on Blackboard as well. Make sure you are familiar and comfortable with the Blackboard interface.

Students are required to have a MasonLive/Email account, which will allow you access to Blackboard and lab computers. Please use this university email account when contacting the professor regarding this class.

## Grading

**Lab Assignments (30%):** Most weeks will have a lab assignment, generally connected to chapters in the Law and Collins lab manual. Students are expected to complete exercises in the Law and Collins text, but will not turn those results in. Rather, an assignment building upon the skills shown in the lab manual will be posted to Blackboard and completed for assessment. While most weeks there will be time at the end of class to begin working on these assignments, students will be expected to complete assignments outside of class. Assignments will be due one week later before class begins (4:30 PM). Please view the calendar at the end of the syllabus to see the schedule of assignments. There will be ten (10) homework assignments overall.

**Midterm Exam (15%):** There will be one midterm exams for this course. The midterm will (most probably) be a mix of multiple choice, fill-in-the-blank, calculations/operations, and short answer questions covering topics from lecture and readings. You will be given 75 minutes to complete the midterm exam.

**Final Exam (25%):** The final will be roughly the same format as the midterms but with the addition of longer essay questions. The final is cumulative, though the last topics of the course, not covered on the prior midterm, will have priority.

**Term Project (30%):** Each student is expected to complete a research project using GIS methods learned and practiced in the course. Students will choose a topic of interest and will develop a research question that will utilize GIS methods to answer. Students will submit a written report,

containing the research question, literature review, methodology, discussion of results, and visual outputs such as a map. More details will be discussed during the semester.

### Grading scale:

<i>Grades</i>	<i>Percentage Required</i>	<i>Grades</i>	<i>Percentage Required</i>	<i>Assignment</i>	<i>Percentage of Total Grade</i>
<b>A+</b>	96 to 100	<b>B</b>	83 to 85.9	Lab Asgmts (10)	<b>30%</b>
<b>A</b>	93 to 95.9	<b>B-</b>	80 to 82.9	Midterm Exam	<b>15%</b>
<b>A-</b>	90 to 92.9	<b>C</b>	70 to 79.9	Final Exam	<b>25%</b>
<b>B+</b>	86 to 89.9	<b>F</b>	<70	Term Proj.	<b>30%</b>

**Note on attendance:** Regular attendance is an expectation. Those that make a habit of missing class tend to do worse in this course than those that do attend. It is in your best interest to come to class and participate as attendance will lead to a better understanding of course concepts. Students are responsible for any announcement given by the instructor during class regardless of their personal attendance.

Students that must miss classes because of religious observances or participation in University activities should provide documentation to the professor within the first two weeks of the course. Reasonable accommodations will be provided for work missed on those days. It is expected that if a student is to have one of these excused absences on a day in which an assignment is due that the student submit the assignment early.

**Make-up and late assignment policies:** Assignment due dates are explicitly stated. **Assignments that are not turned in by the due date will result in a 50% deduction for the assignment.** This penalty begins 1 minute after the due date! Assignments will be accepted up to the final regular class meeting of the semester (May 2nd). Technical excuses ("computer system error", "didn't submit correctly on Blackboard", etc.) will not be accepted as reasons for late work. You are expected to start the work early. **Never underestimate the time you will spend on the assignments.**

If you are ill or physically indisposed and cannot submit your assignment on time, you must notify the instructor before class for you to have a chance to make up the assignment. Make-up exams will be given only for University approved excused absences. This policy may seem strict, but it is in your best interest to turn in everything on time to avoid falling irrecoverably behind. Please contact the instructor if you are struggling and you will receive aid as best as the instructor can provide. If you cannot complete the assignment on time, it can sometimes be better to turn in partially completed work than nothing at all.

### Administrative

**Academic integrity:** *The following statement is adapted from the Stearns Center for Teaching and Learning.* No grade is important enough to justify academic misconduct. The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code, which you can read fully at the Office for Academic Integrity (<https://oai.gmu.edu/mason-honor-code/>). The Honor Code Pledge 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 for this Honor Code: Student Members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

The Mason Honor Code defines cheating, plagiarism, stealing, and lying. It is expected that you understand these definitions. If you have any doubts about what constitutes cheating, plagiarism, stealing, or lying in the academic context, please see your professor. **Acts of academic dishonesty in this course may be penalized with failure of either the work in question or the entire course.**

While collaboration and group learning is encouraged in this course, each student **absolutely must** turn in their own work, from their own computer, and any discussion must be theirs alone, and not attributable to another person or group, *except where noted* (for example, quoting authors as a small portion of your scholarly work). This also applies to online sources; you cannot copy the words of anyone else for any graded part of this course. It is not enough to exchange a few synonyms within a sentence! You must write, summarize, and analyze with your own words and ideas.

**Disability statement:** This course is in compliance with Mason policies for students with disabilities. Students with disabilities are encouraged to register with Disability Services (DS). DS can be contacted by phone at (703) 993-2474, or in person at SUB I Suite 2500, or online by the link at the end of this section. Students who suspect that they have a disability, temporary or permanent, but do not have documentation are encouraged to contact DS for advice on how to obtain appropriate evaluation. A memo from DS authorizing your accommodation is needed before any accommodation can be made. The memo should be furnished to the professor preferably within the first two weeks of class or as soon as an accommodation is made. Please visit <https://ds.gmu.edu/> for more information.

**Mason diversity statement:** From <https://stearnscenter.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.

**Mason policy on sexual harassment, sexual misconduct, and interpersonal violence:** As a faculty member and designated “Responsible Employee,” I am required to report all disclosures of sexual assault, interpersonal violence, and stalking to Mason’s Title IX Coordinator per [university policy 1412](#). If you wish to speak with someone confidentially, please contact the [Student Support and Advocacy Center](#) (703-380-1434), [Counseling and](#)

[Psychological Services](#) (703-993-2380), [Student Health Services](#), or Mason's [Title IX Coordinator](#) (703-993-8730; [cde@gmu.edu](mailto:cde@gmu.edu)).

**Use of electronic devices:** Your professor encourages the use of devices that both aid your learning ability and do not distract from the learning of others. With the exception of mobile phones and audio/video recorders, you are free to use any electronic device that fulfills both of those conditions. All electronic devices should be muted or silenced. Please be respectful of the class and avoid use of social media during class which can distract both you and your classmates. You are expected to adhere to Mason's student code of conduct; disruptive behavior will result in classroom removal. Audio/video recording requires the consent of the professor.

**University-wide closures and class cancellations/delays:** There may be times during the semester in which George Mason University announces university-wide closures or delays. Should inclement weather or another emergency force Mason to close, causing our class to cancel meeting times, we will not meet. Check the Mason website and our own Blackboard site for updates. Other cancellations or delays to class will be announced via Blackboard by your professor. In the event that this course has missed meeting times, the course schedule, assignment deadlines, and other course alterations will be decided upon and announced via Blackboard and email by the professor. You are expected to stay abreast of any changes.

**Instructor availability:** Please do not hesitate to contact your instructor if you have questions about course topics or assignments. Your instructor will do his best to answer all weekday emails within 24 hours, and weekend emails within 48 hours. Should you not receive a response within that time frame, you may send a gentle reminder via email. Do try to avoid last-minute emails, as your instructor may not have email accessible immediately before deadlines. It is generally a good practice to avoid sending an email at the first sign of trouble with an assignment; many times you will find the proper solution by giving yourself an hour or two to problem solve!

Please also make use of the office hours listed at the top of this document. Generally, issues can be clarified quickly in person.

## GGG 553 Course Schedule

Under readings, B is for the Bolstad text and LC for Law & Collins. B 1 means Bolstad, Chapter 1. Readings for lectures should be completed before the course meets. Readings for labs are the chapters you will independently work on during lab time and do not need to be reviewed before the course meets.

Dates		Lecture Topics	Reading	Due
Week 1	Jan 24	Course overview, GIS history, ArcGIS, and file types	B 1 LC 1, 2	
Week 2	Jan 31	Spatial data representation Lab 1: Exploring spatial data	B 2 LC 3, 4	
Week 3	Feb 7	Mapping and cartography Lab 2: Cartographic principles	B 4 LC 7, 8, 9, 10	Lab 1
Week 4	Feb 14	Geodesy, datums, and projections Lab 3: Projections	B 3	Lab 2
Week 5	Feb 21	Digital data and tables Lab 4: Joining tables	LC 6	Lab 3
Week 6	Feb 28	Digitizing and coordinate transformation Lab 5: Digitizing and editing data	B 4 LC 11, 12, 13	Lab 4
Week 7	Mar 7	GPS and remote sensing <b>Midterm Exam</b>	B 5, 6	Lab 5
Week 8	Mar 14	<i>Spring Break – no class</i>		
Week 9	Mar 21	Vector spatial analysis Lab 6: Geoprocessing	B 9 LC 18, 19	
Week 10	Mar 28	Raster spatial analysis Lab 7: Analyzing rasters	B 10, 13 LC 20	Lab 6
Week 11	Apr 4	<i>AAG Conference – No class (work on project proposal)</i> Lab 8: TBA		Lab 7
Week 12	Apr 11	Networks and geocoding Lab 9: Geocoding	B 9 LC 14	Lab 8 Proj Prop
Week 13	Apr 18	Spatial estimation and terrain analysis Lab 10: Spatial estimation and terrain	B 11, 12	Lab 9
Week 14	Apr 25	Data standards and data quality Working on term project	B 14	Lab 10
Week 15	May 2	Working on term project		
Week 16	May 9	<b>Final Exam: Thursday, May 9, 4:30 – 7:15 PM</b>		Term Proj.

**Note:** The GGS 553 course schedule is tentative and is subject to revision by the instructor