



Department of Geography and Geoinformation Science

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GGG 650 DL1

Introduction to GIS Programming and Algorithms (Tentative Syllabus - Spring 2015)

1. Introduction

- **Instructor:** Dr. Nektaria Tryfona
- **Course Website:** gmu.blackboard.edu
- **Credits:** 3.0
- **Prerequisites:** Graduate Students: GGS 553 or equivalent introductory course or permission of instructor
- **Course Forum:** Blackboard. Allow 24hrs for an answer.
- **Office:** Exploratory Hall, 3104
- **Email:** ntryfona@gmu.edu (Please allow up to 24 hours for response M-F)
- **Phone:** 703 993 4884
- **Office Hours/Skype:** By appointment
- **Skype Name:** tryfona
- **Preferred Contact method:** email (daily), skype (scheduled), Blackboard collaborate (scheduled)

2. Course Objectives

In this course you will learn to develop Python programs and identify and use open source tools and libraries to achieve geospatial solutions. More specifically, you will:

- develop fundamental GIS programming skills
- design and develop algorithms to solve spatial problems
- apply programming techniques and algorithms in hypothetical and real-world data processing tasks
- identify and use libraries for manipulating geospatial data
- employ Python to implement spatial computational solutions and applications
- use open source environments to implement geospatial solutions and applications

3. Technology Requirements

Hardware

You will need access to a Windows or Macintosh computer with at least 2 GB of RAM and to a fast, reliable broadband Internet connection (e.g., cable, DSL).

For optimum visibility of course material, the recommended computer monitor and laptop screen size is 13-inches or larger.

You will need computer speakers or headphones to listen to recorded content.

A headset microphone is recommended for live audio sessions using course tools like Blackboard Collaborate.

For the amount of computer hard disk space required to take an online course, consider and allow for the space needed to install the required and recommended software and save your course assignments.

For hardware and software purchases, visit [Patriot Computers](#).

Software

You will need:

- A supported web browser (See [Blackboard Support](#) for supported web browsers)
- Blackboard Courses (Log into <http://mymason.gmu.edu>, select the Courses Tab)
- Blackboard Collaborate (Select Tools from the Blackboard Course Menu, then select "Blackboard Collaborate")
- Adobe Acrobat Reader ([free download](#))
- PDF Creator - An open source PDF printer ([free download](#))
- Flash Player ([free download](#))
- Windows Media Player ([free download](#))
- Microsoft Office ([purchase](#), also available in the GGS computer labs in Exploratory Hall 2101)

All software and libraries (Python, GDAL/OGR, Mapnik, Shapely, QGIS) needed for this course are open source and is available:

- i. the GMU [Virtual Computing Lab](#) - choose **GGS Ubuntu 12.4** when making a reservation and
- ii. as a [Virtualbox Image](#) - **download** image from [here](#). Please, follow the instructions in [FAQ](#) to **install** the Virtualbox Image.

In addition, you will also need access to a word processor and a PDF document generator.

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 type

4. Textbook and References

Required textbook:

Python Geospatial Development, Erik Westra, 2013 Packt Publishing.

Links to be used:

- Python Tutorial <https://docs.python.org/2.7/tutorial/index.html> (2.7)
- Python Library <http://docs.python.org/2/library/index.html>
- Shapely Library <http://toblerity.org/shapely/index.html>
- Simply Easy Learning Tutorial Point
http://www.tutorialspoint.com/python/python_overview.htm
- Python Shapefile Library (for reference) <http://code.google.com/p/pyshp/>
- Numpy: www.numpy.org

Additionally, students will be provided additional material in the form of handouts and Web links.

Optional References and Readings:

For more practice with Python, please refer to:

- <http://www.learnpython.org>

Documentation on Libraries:

The GDAL/OGR Cookbook:

- <http://pcjericks.github.io/py-gdalogr-cookbook/index.html>

(includes simple code for understanding how geometry is handled with GDAL/OGR. It is an alternative approach to Shapely, which makes complex calculations based on GDAL/OGR).

5. Course Format

The course will be taught as a combination of modules, topic/problem oriented discussion, and tutorials based on independent reading and class discussion.

The course follows a weekly schedule:

- Wednesday: (0:01am) weekly module available
- Monday: (6-7pm) Collaborate session to discuss problems, issues (see link below)
- Tuesday (11:59pm ET): lab submission deadline
- All the time: Forum for questions, problems, discussions

6. Tentative Course Schedule

The course will be taught as a combination of lectures, topic/problem oriented discussion, and tutorials based on independent reading and class discussion.

The following topics will be covered. (please note that the topics and their order are subjected to change at the discretion of the instructor, any changes will be announced in class):

Lec. #	Topic	Assignment
1	Introduction and course overview	
2	Programming, algorithms and GIS	Experience the Python Environment "Hello World"
3	Fundamental Python Constructs Basic Geo Types	Perform basic calculations with Python
4	Control Flow and functions Spatial calculations	Use of control flow and functions
5	Object classes Spatial calculations	Work with geometric object classes
6	Object inheritance Python environment handling components	Perform spatial calculations in geometric object classes
7	Algorithmic thinking	Pseudo-code and general scope questions
8	Midterm, introduction to project and second course section	Project presentation
9	Geo Data formats - Shapefiles	Project assignment Practice
10	Geospatial development Manipulating vector data	Practice
11	Geoprocessing	Practice
12	Manipulating vector data	Practice
13	Project presentations	
14	Project presentations	

7. Course's website - Online Communication

This course has a Blackboard website which will provide you a single portal to obtain lecture notes, retrieve assignment data, review links to additional materials and receive special announcements.

Working online requires dedication and organization. You are required to visit the

course website **once per day**. Please notify ITU (and, if necessary, the instructor) if you encounter problems accessing the website.

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. I encourage you to learn more about [Netiquette](#).

8. Assignments

The course includes 6 written assignments on selected topics from the material covered in class and in the assigned reading. Assignments focus on developing Python programs. You are expected to bring working cases (valid answers, readable files, working programs) to each class, and -when applicable- be prepared to demonstrate their solution. All assignments are mandatory. Typically, one week will be allocated for every assignment.

Assignments should be done **through the Blackboard course website**. (Do not email assignments directly to the instructor).

Late assignment submission

Assignments submitted **after the due date will not be accepted**. Exceptions to this policy may be made given serious circumstances at the discretion of the Instructor. Please note that deferred of term work is a privilege and not a right; there is no guarantee that a deferral will be granted. Please make sure you notify the instructor as soon as you know a deferral is required.

General guidelines for ASSIGNMENT preparation and submission

- a. Grades of assignments will be based on:
 - **Academic merit** of your answers.
 - **Conciseness** and **completeness** of your answers. Please write to the point and explicitly address the question or task. Avoid using unnecessary graphics (figures, tables, graphs etc.) unless they serve a specific purpose. Make sure to use captions and to refer to the graphics you include in your written answer. Graphics without any reference or accompanying explanation will be disregarded.
 - **Organization** and **presentation**. Remember that your assignment report is a reflection of your thinking and learning process. Please organize your report in a logical fashion so that your answers could be easily identified. A general format for your presentation should, as a minimum, include the following components: (1) Question number, (2) Your written answer and/or description and discussion of your results, and (3) Visualization of your results, e.g. images, graphs, tables, as necessary.
- b. Please remember that your assignment is a **professional document**, and should therefore be formatted and constructed accordingly. All assignments are to be typed. Hand-written assignments will not be accepted.
- c. Submission of a hardcopy will be made in class; submission of a softcopy

will be made through Blackboard.

- d. The electronic submission of your assignment report has to be in **PDF format**.
- e. If more than one file is submitted, you may submit a single **ZIP** file containing all the assignment files.
- f. Each assignment submission should include a cover page with the following information: assignment title, assignment number, student name, and submission date.
- g. Please make sure you have a backup of all the materials you submit.

9. Practice

The course will include practice assignments, which will not be delivered or graded, however they are **essential** to the successful delivery of the final project. Material for each practice will be given on time.

10. Exams

The course includes a mandatory midterm written exam. The material covered in the exams will be announced in class. A student who cannot write a course examination or complete a course assignment because of an incapacitating illness, severe domestic affliction or other compelling reasons can apply for extension of time to complete an assignment.

11. Project

The course includes a project addressing a GIS problem to be addressed with Python programming and the selected open source GIS tools.

The project's deliverable will consist of (i) a written report, (ii) a software demonstrator and (iii) an in e-class presentation of the project results incl. a live demonstration. The specific format and timing of the project will be discussed in class.

The project will be graded based on the following criteria:

- **Academic merit** of your project
- **Quality of the written report.** The project results need to be communicated in a written report. Please remember that your report is a professional document, and should therefore be formatted and constructed accordingly. A template will be made available. Submission of a hardcopy of the report will be made in class; submission of a softcopy (in PDF) will be made through Blackboard.
- **Quality of the demonstrator** as assessed by the instructor and fellow students during the presentation of the project.

- **Quality of the presentations of the project results** as assessed by the instructor and fellow students. Students will be required to present their results in-class. The presentation will include a demonstration of the developed system.

12. Grades

Each assignment and written exam will be given a numerical grade on a 0-100 scale. Some assignments may include bonus tasks. At the end of the term all the marks will be totaled as a weighted average according to the following weights:

Lab assignments	40%
Midterm	25%
Project	35%

Please note that in general all assignments will not have the same weight. The weight of each individual assignment will be indicated on the assignment form. Final grades at the end of the course will be assigned using **a combination of absolute achievements and relative standing in the class forum.**

13. Important Dates

Please refer to the GMU Semester Calendar for information on important dates.

14. Student Expectations

Academic Integrity

Students must be responsible for their own work, and students and faculty must take on the responsibility of dealing explicitly with violations. The tenet must be a foundation of our university culture. [See <http://academicintegrity.gmu.edu/distance>].

Honor Code

Students must adhere to the guidelines of the George Mason University Honor Code [See <http://academicintegrity.gmu.edu/honorcode>].

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 <https://thanatos.gmu.edu/masonlive/login>].

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://thanatos.gmu.edu/passwordchange/index.jsp>].

Responsible Use of Computing

Students must follow the university policy for Responsible Use of Computing. [See <http://universitypolicy.gmu.edu/1301gen.html>].

Students with Disabilities

Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See <http://ods.gmu.edu>].

Students are expected to follow courteous Internet etiquette.

15. Student Services

Student Resources

For technical questions regarding Blackboard, see [Courses Support](#) and [Blackboard Tutorials](#). If you still have questions, email courses@gmu.edu for assistance with Blackboard.

For technical questions regarding computer networking, see [IT Services for Students](#). If you still have questions, email support@gmu.edu or call (703) 993-8870.

University Libraries

University Libraries provides resources for distance students. [See <http://library.gmu.edu/distance>].

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 an Online Writing Lab (OWL) session just like you sign up for a face-to-face session in the Writing Center, which means YOU set the date and time of the appointment! Learn more about the [Online Writing Lab \(OWL\)](#) (found under Online Tutoring).

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/privacy>].

16. Disclaimer and Copyright Notice

Disclaimer: Any typographical errors in this Course Outline are subject to change and will be announced in class.

Notice: Recording of any kind (e.g., audio, video), reuse or remix of course materials, and further dissemination of the course content is not permitted unless prior written consent of the professor and George Mason University has been given or if recording is part of an approved accommodation plan.