Geography 378: Introduction to Geocomputing

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Instructor

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Course Overview

Geography 378 will introduce students to the scripting and programming tools and skills commonly employed in GIS and spatial analysis. The skills learned in this course are equally applicable in scientific research, the public sector, and private industry. This course helps satisfy the programming requirements of the Cartography/GIS undergraduate major. The only prerequisite is Geography 377, which may be taken concurrently. No programming background is assumed for this course.

This course will be taught as a blended or 'hybrid' course, with online lecture content and in-person lab sessions. You are expected to attend every lab session unless you contact the TA in advance for an excused absence. All lecture material will be delivered via online modules in the D2L site for the course.

Course Learning Objectives

After completing this course, students will:

- Have basic skills in the Python programming language, and they will have acquired programming concepts necessary for advanced GIS courses that require programming.
- Be able to write shell commands to accomplish common geoprocessing tasks using popular open-source utility programs, and they will learn when these utilities are preferred over mainstream GIS software.
- Know how to use Python and the command shell with open-source GIS libraries. Students will also learn how Python can extend the capabilities of ArcGIS to solve problems difficult or impossible to address otherwise.
- Be familiar with major geospatial vector and raster file formats and specifications for spatial reference coordinate systems.
- Have used and be comfortable with online resources that support geocomputing and programming in the GIS profession.

Course Materials

- **Textbook**: *Think Python: How to Think Like a Computer Scientist* by Allen Downey, 2014. This is available as pdf or html at no cost from www.greenteapress.com (recommended) or in paperback or Kindle book from www.amazon.com.
- **Recommended Readings:**
  - Non-Programmers Tutorial for Python 2.6, by J. Cogliati, 2007, 90 pp Available at no cost from Wikibooks (http://en.wikibooks.org/wiki/Non-Programmer's_Tutorial_for_Python_2.6).
  - Core Python Programming, 2/e, by W.J. Chun, Upper Saddle River, New Jersey: Prentice Hall, 2007, 1120 pp. Available online via the UW Library Safari subscription.
  - Introduction to Computer Science Using Python: A Computational Problem-solving Focus, by C. Dierbach. New York: Wiley, 2013, 580pp.
  - A Python Primer for ArcGIS, by N. Jennings. Nathan Jennings, 2011, 462 pp.
  - Python Scripting for ArcGIS, by P.A. Zandbergen. ESRI Press, 2013, 353 pp.
- **Additional Reading Material**: Additional reading material will be provided as needed.

What is expected of you (the student)

You must attend all lab sessions and complete all course readings, assignments, and exams on time. You must appropriately comment all code you submit for a grade. Please seek assistance when you have a question or problem through office hours and/or your peers (more on this below). If you face any personal or professional difficulties or require accommodation for a disability, please let me know as soon as possible.

Most of all, you are expected to take advantage of the resources that are offered in the course and do your best to overcome any obstacles to learning you encounter. In this course and learning programming generally, *you will fail* from time to time. Everyone does. The trick is to pick yourself up and try again rather than getting discouraged. And ultimately, the hope is that you will not just succeed, but *have some fun* in the process.

What you can expect of me (the instructor)

I try to bring passion and enthusiasm to the topics I teach. I intend to lay out expectations in a clear and concise manner through weekly (or more frequent) communications, and will monitor your grades and discussion posts as they come in. Occasionally, you will see me post in class discussions in answer to questions or to contribute to a particularly interesting conversation. I will be as responsive as I can to student e-mails; typically, this means I will get back to you within 24 hours. I'm likely to respond more quickly than this during the work week, but will do my best to get back to you in a timely manner if you e-mail me over the weekend. If for some reason I'm unlikely to respond to messages within 24 hours, I will set a vacation responder. Barring the unforeseen, we will provide feedback and scores on all assignments within 7 days after they are submitted.

Communication and Discussion

Course communications will occur through the class e-mail list and news items I post to D2L. Please check your wisc.edu e-mail regularly and visit the Learn@UW D2L site for the course frequently. You must have access to the D2L site, as all of the lecture materials and exams will be posted there. Please e-mail me immediately if you experience a technical problem.

You will not be able to send messages to other students through the Wiscmail classlist, but we do encourage you to collaborate with your peers using Piazza Q&A. For those who haven't used Piazza before, you'll find it as an option under the course "Communication" menu. With Piazza you can post a question to the class and other members (including the instructors) can build an answer collaboratively. One big advantage of Piazza is that students don't need to chase through a long string of posts looking for a hidden gem that addresses the question. It also allows for uploading of pictures (such as screen shots) and files. It also lets students ask and answer questions anonymously, which is great when you're not 100% confident about an answer or if you're worried a question might sound dumb.

We encourage you to reach out beyond the bounds of the University and take advantage of online resources you find to help you learn the material. If you find a resource that you think would be useful to your classmates, please e-mail me a link and I will post it to the News feed. One caveat: the work you turn in must represent your own effort; submissions that are identical to those of your classmates or something you found online will not receive credit.

Course Software

The examples and exercises require specific software, as described in the *Getting Started* section of the course. One piece, ArcGIS, will run only on the Windows operating system, and therefore the course assumes students are using a Windows computer. Much of the other course software is available for other operating systems (including OS X), but we have not tested configurations other than Windows 7 and Windows XP, and thus can't provide much in the way of support for other operating systems. If you use another operating system for part of the course, please remember that it will not work for some topics and that you will need to have access to a Windows computer properly configured with the course software for those topics.

In addition to 380 Science Hall, where your lab sessions will be held, computers in M376 Science Hall (the Geography computer lab), the Geography Library, and the Robinson Map Library, are all loaded with the necessary software. These three facilities are generally open during weekday business hours (9-5 Monday-Friday).

Course Assignments

Exams

There will be four exams consisting of a mix of multiple-choice and short answer questions based on the lecture material. The exam period **will be open for one week and closes at 11:59 p.m. on the due date**. Once you begin an exam, you will have 60 minutes to complete it.

***NOTE**: Students may use course materials, books and internet resources to answer exam questions. However, they may not consult with other individuals either in person or remotely.*

Lab Assignments

Labs assignments are designed to apply the lecture material to hands-on programming. In addition to lecture notes, you may use the course text, recommended readings, and any other resources you find online to complete your labs. You *may* copy code you find online *if it is legally permissible for you to do so, you give appropriate credit to the original author in code comments, AND a substantial part (>50%) of the final solution is your own creation.* Keep in mind that it is up to you to decide whether to master the skills taught by the labs; failing to do so will only hurt you in the long run. **Lab assignments are due by the beginning of the lab period of the date listed in the schedule.** *Please attend your designated lab session every week, and e-mail the TA if you need to swap sections.*

Course Survey

There will be course survey open throughout whole semester. The purpose of the survey is to help us to understand your learning experiences and investigate ways to improve this course for future learners. Your responses will be confidential, and we encourage your participation to make this program better!

Late Assignments

Late lab assignments will be accepted, but are penalized **10%** per day, including weekends. Assignments will not be accepted more than 4 days after the due date. If you cannot submit a lab by the deadline because of a valid excuse or emergency, you must contact the TA before the deadline. Late exams will not be allowed without a prior excuse.

Grading

There will be 4 exams worth a total of 30% of your grade and 8 lab assignments worth 70% of your grade. The grade breakdown is tentatively as follows:

A	> 90	AB	87-90	B	80-87	BC	77-80
C	70-77	D	60-70	F	< 60		

Requests for grade changes must be submitted in writing (via email) within 24 hours of receiving your feedback.

Course Schedule

The schedule below is tentative and may change at the instructor's discretion.

Week	Lecture	Lab Assigned	Lab Due Date
1 (9/6-9/11)	Topic 1: Python Basics	Course overview and Q&A	
2 (9/12-9/18)	Topic 2: Python Control Flow No Carl Office Hours Thursday (AutoCarto)	Lab 1: Introduction to Python	9/28
3 (9/19-9/25)	Topic 3: Python Functions	Review & Work Period	
4 (9/26-10/2)	Topic 4: Python Containers	Lab 2: Python Functions and Containers (LAB 1 DUE)	10/12
5 (10/3-10/9)	Topic 5: Python Copies **EXAM 1 DUE 10/9** (Topics 1-4)	Review & Work Period	
6 (10/10-10/16)	Topic 6: Reading and Writing Files	Lab 3: Python I/O (LAB 2 DUE)	10/26
7 (10/17-10/23)	Topic 7: Python Objects No Carl Office Hours (NACIS)	Review & Work Period	
8 (10/24-10/30)	Topic 8: Introduction to Shell Scripting **EXAM 2 DUE 10/30** (Topics 5-7)	Python Objects WS (LAB 3 DUE)	11/9
9 (10/31-11/6)	Topic 9: GDAL and OGR	Lab 4: Batch Files, GDAL, and OGR	11/16
10 (11/7-11/13)	Topic 10: Python System Access	Review & Work Period	11/23
11 (11/14-11/20)	Topic 11: Using GDAL with Python **EXAM 3 DUE 11/20** (Topics 8-10)	Lab 5: Python and GDAL (LAB 4 DUE)	
12 (11/21-11/27)	Topic 12: Using OGR with Python No Carl Office Hours Thursday (Thanksgiving)	Lab 6: Python and OGR	12/7
13 (11/28-12/4)	Topic 13: Python and ArcGIS	Lab 7: Python and ArcGIS (LAB 5 DUE)	12/14
14 (12/5-12/11)	Topic 14: Python and QGIS	Review & Work Period (LAB 6 DUE)	
15 (12/12-12/15)	**EXAM 4 DUE 12/15** (Topics 11-14)	No Lab (LAB 7 DUE 12/14) No Scott Office Hours	