Geog 378 - Introduction to Geocomputing

Department of Geography
University of Wisconsin
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Description:

Geography 378 (GEOG378) 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 in industry. This course helps satisfy the programming requirements of the Cartography/GIS undergraduate major. The only pre-requisite for GEOG378 is GEOG377, which may be taken concurrently. No programming background is assumed for this course, but, because programming is an integral part of the course we strongly encourage students to make efforts to ensure they understand and practice the programming concepts discussed in this course.

This is a one-semester, 3-credit course. The course content is provided through 16 learn@uw D2L modules consisting of lecture "notes", worked examples and ungraded self-assessment exercises. All examples and exercise solutions can be downloaded from the course webpage. Research has shown that students who undertake self-assessment exercises regularly score higher on quizzes and in course assignments. It is strongly recommended that you complete these exercises in addition to your regular labs and quizzes.

Because this course is offered online we will manage course related discussion among students and between students and the instructors through Piazza Q&A. Piazza offers the ability to post questions publically, discuss problems and propose solutions, and, if you're feeling self-conscious about a question or comment, Piazza allows you to post anonymously. Because we often receive the same question multiple times I will be posting student questions to Piazza when appropriate and addressing them on Piazza where possible.

Learning Outcomes

After completing this course students will:

- Be able to write shell commands to accomplish common geoprocessing tasks using popular open-source utility programs.
- Learn when scripted solutions are preferred over mainstream GIS software.
- Develop basic skills in the Python programming language, and acquire programming concepts necessary for advanced GIS courses that require programming.
- Know how to use Python with open-source GIS libraries.
- 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.

Grading

If you require reasonable accommodation, please inform the instructor as soon as possible.

Course grades will be based on 16 quizzes (40% of grade) and 8 laboratory assignments (60%). Quizzes will be given weekly and will cover the material presented in the course notes with an emphasis on concepts and vocabulary. Lab assignments will require original programming based on lecture material. Lab assignments are not scheduled weekly, but there will be weekly lab time scheduled (consult your lab section for times) and you can use this time to work on your assignments or work through course material.

There is no final exam or other summary activity.

Quizzes will open on Mondays (at 6:00AM, Madison time) and end the following Monday (at 6:00AM Madison time). The first quiz is open from Aug 31 – September 7, effectively the first week of school. Each quiz is a timed activity and must be completed in 30 minutes. Students may use course materials, books and internet resources to answer questions. However, they may not consult with other individuals either in person by other means (such as the internet).

Labs assignments build on material covered in the notes. Each lab will take 3-4 hours of time----please plan accordingly. Labs are due by midnight Monday of the following week. Please note that the final lab is due Monday December 22nd, after instruction ends. Late 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 (i.e., midnight on Saturday). If you cannot submit a lab by the deadline because of a valid excuse or emergency, you must contact either myself or the TA before the deadline.

Your lab assignments will be graded on whether they run or not, but you will receive partial credit for (1) mapping out your code and (2) commenting the code well.

There are lots of opinions on what makes good code and good comments. In general I urge you to follow the Python Style Guide [here], but if your code isn't working please take care to use comments to detail what isn't working, how you think things should work, and what you would do from that point. Pseudocode can be very useful, and I urge you to use it, or some other method to plot out your

Texts

The primary text is *Think Python: How to Think Like a Computer Scientist* by Allen Downey, 2014. The book is available in either PDF or HTML formats at no cost from Green Tea Press and as a paperback or Kindle book from Amazon. Some other books that may be helpful are listed below. You will also need access to a variety of material available through the internet. Required readings are listed in the introduction to each topic.

Course Software

The examples and exercises used in this course 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 or have access to one.

Much of the course software is available for other operating systems (including OS X) and you are welcome to investigate and use those other versions. However, certain programs, such as GDAL and Python have platform specific setup steps and we have not tested configurations other than Windows 7 and Windows XP. In cases where you wish to use another operating system we cannot guarantee that we will be able to troubleshoot the problem, however course discussion is supported on Piazza Q&A through Learn@UW and participants are encouraged to help one another with any resources they've found.

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. Computers are available in the Geography Computer Lab (Room M376), the Geography Library (Room 280), and the Robinson Map Library (Room 310). All of these places have computers with the necessary software installed. However, these facilities are open only during weekday business hours (generally 9:00-5:00).

Topics and Schedule

This schedule represents the best estimate of the course timetable at this point. If the course schedule changes you will be notified one week in advance.

Week	Topic	Quiz	Lab Due Date
Sept 4	Getting Started	Yes	
S7-11	Command Shells and Shell Scripting	Yes	
S14-18	Spatial Reference Systems and Data	Yes	Lab 1 S21
S21-25	GDAL and OGR Utility Libraries	Yes	Lab 2 S28
S28-O2	Python: Basics	Yes	
O5-9	Python: Functions	Yes	Lab 3 O12
O12-16	Python: Flow Control	Yes	
O19-23	Python: Containers	Yes	Lab 4 O26
O26-30	Python: Containers II	Yes	Lab 5 O2
N2-6	Python: Memory, Copies & Files	Yes	
N9-13	Python: System Access	Yes	
N16-20	Python: Objects	Yes	Lab 6 N23
N23-27	GDAL and Python I	No	
N30-D4	GDAL and Python II	Yes	Lab 7 D7

D7-11	OGR and Python	Yes	
D14-15	ArcGIS and Python (ArcPy)	Yes	Lab 8 D21

Supplementary Books

Cogliati, J. 2007. Non-Programmers Tutorial for Python 2.6. Wikibooks [free] http://en.wikibooks.org/wiki/Non-Programmer's_Tutorial_for_Python_2.6

Chun, WJ. 2007. Core Python Programming, 2/e. Prentice Hall. Upper Saddle River, New Jersey. 1120 pp. Available online via the UW Library Safari subscription. (Use a MadCat title search to locate.)

Dierbach, C. 2013. Introduction to Computer Science Using Python: A Computational Problem-solving Focus. Wiley, New York, NY. 580pp.

N. Jennings. 2011. A Python Primer for ArcGIS. 462 pp.

Zandbergen, PA. 2013. Python Scripting for ArcGIS. ESRI Press, Redmond, CA. 353 pp.

External Resources

GIS StackExchange - http://gis.stackexchange.com/

NaturalEarthData - http://www.naturalearthdata.com/

North American Cartographic Information Society - http://nacis.org/

Python Style Guide - https://www.python.org/dev/peps/pep-0008/

Please add any other resources on the class Piazza Q&A message board.