

GIS PROGRAMMING FUNDAMENTALS (WITH PYTHON)

- objectives
- requirements
- logistics
- guidelines

Dr. Tateosian



Course topic

- GIS programming (through the use of the Python programming language)
 - General programming concepts, as well as Python syntax.
 - Python language elements for programming ArcGIS.
 - Processing/analyzing data.
 - Performing batch processing and manipulating map elements.
 - ESRI script tools to create graphical user interfaces.

Course learning outcomes

- Students will be able to...
 - interpret **basic Python syntax** (indentation, context highlighting)
 - write Python scripts in an **integrated development environment** (PythonWin)
 - use Python to construct code using **core data structures** (strings, lists, ...)
 - call **ArcGIS tools** with Python (arcpy.buffer...)
 - handle **contingencies** within Python (if, else...)
 - construct basic **batch processing** Python code (looping)
 - read/modify **data files** with Python
 - create a graphical **user interface**
 - do more...

Course project examples

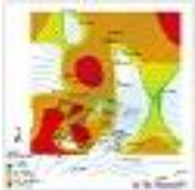


400 loc

“Gridded Coastline Simplification of Postal Code Polygons” - W. Morelli

Input High vertex count postal polygons, grid size specs.

Output Map and Webpage with simplified postal code polygons, table of vertex counts



727 loc

“Groundwater contamination analysis for military installations with leaking underground storage tanks” - E. Bouton

Input Tables (CSV format) with water depth measurements (from the field) and lab analysis results.

Output Map and Webpage with automatically generated groundwater elevation contours and BTEX contamination plume surfaces.

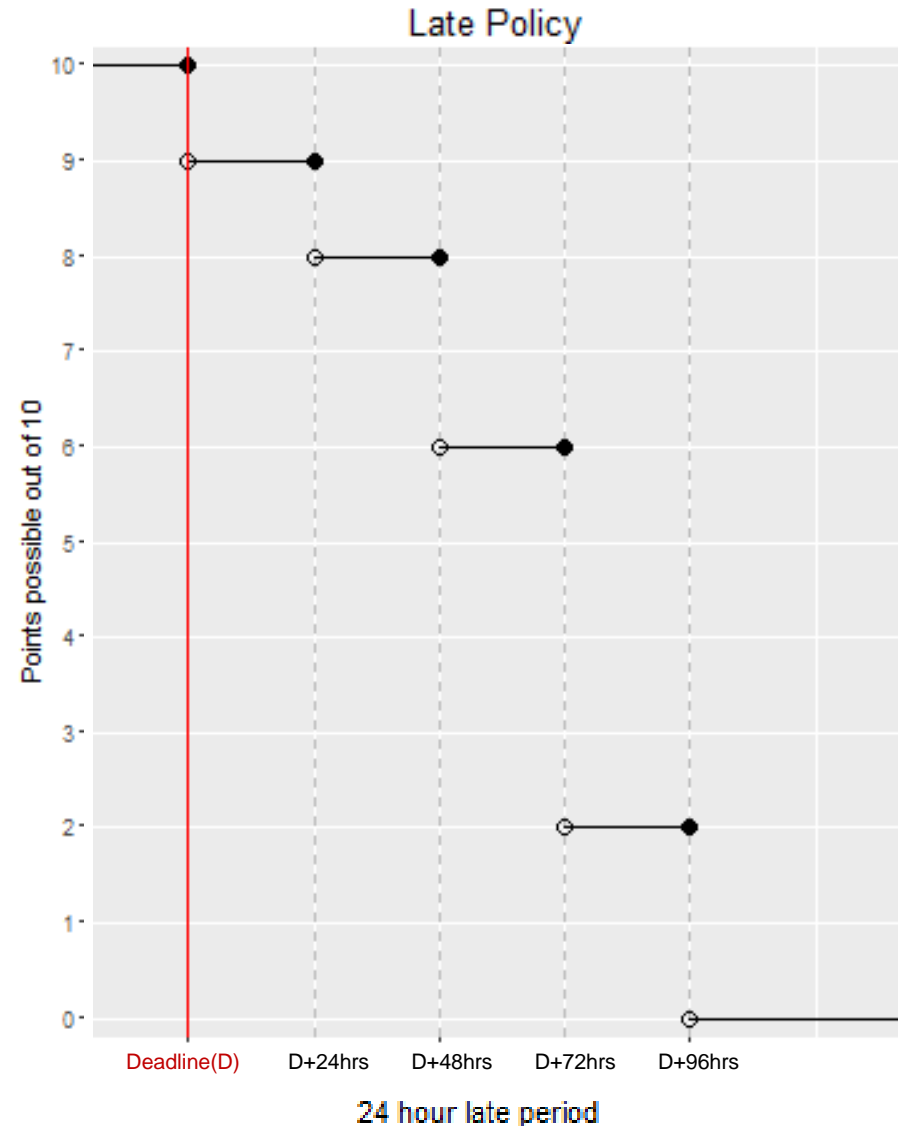
Textbook and data

- *Required textbook:* Tateosian, Laura. [Python for ArcGIS](#). Springer, 2015.
 - hard copy available for purchase
 - electronic version available for free to NCSU students (*pdf* recommended over eBook)
- Download the data and sample scripts from <http://go.ncsu.edu/gispy>



Grading

- Two midterm exams (30% each)
- Project (25%)
- Homework (15%)
- Homework late policy:
 - penalty = $10 * 2^{(r-1)}\%$ where r is the number of 24-hour periods late



Grade changes

- Grades and comments posted in the Moodle gradebook.
- Grade change requests must be submitted within one week of being returned.
- Submit grade change requests via private (to instructors) note on the message board. Be sure to provide the assignment number and question name and briefly explain the issue.
- Our goal is fair grading and we want to correct any errors.

The screenshot shows the Moodle 'Post' form for a grade change. Key elements highlighted with yellow boxes include:

- Post Type:** The 'Question' radio button is selected, with the text 'if you need an answer' below it.
- Post to:** The 'Individual Student(s) / Instructor(s)' radio button is selected.
- Enter one or more names...:** A text input field containing 'Instructors' with a red 'x' icon, indicating a search or selection process.
- Select Folder(s):** A row of buttons labeled 'hw1' through 'hw9', with 'hw2' selected.
- Summary:** A text area containing the text 'HW 2 Chapter 2 #5) times.py possible grading error'.
- Details:** A section with a 'plain text editor' label and a rich text editor toolbar.

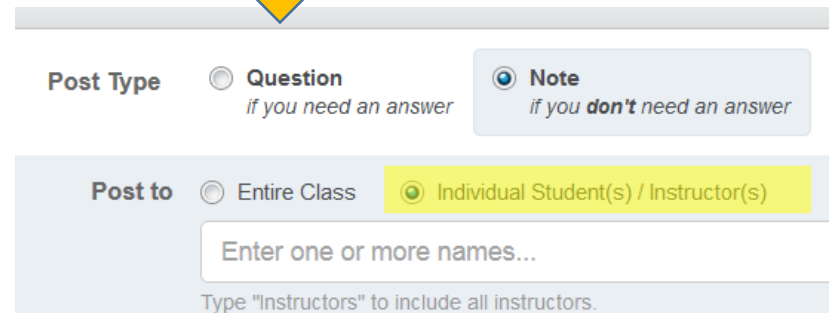
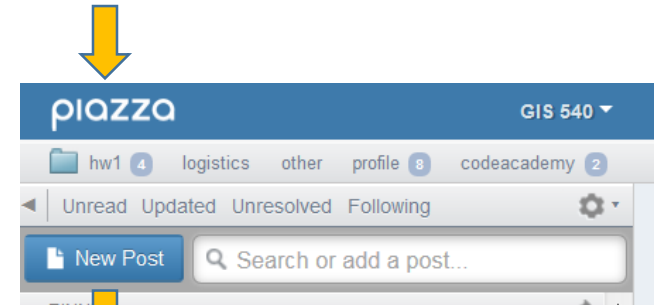
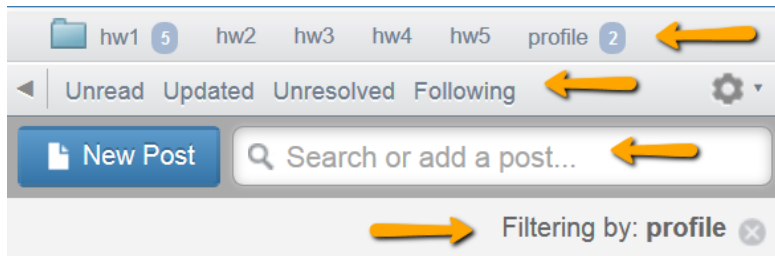
The rich text editor toolbar includes buttons for bold (B), italic (I), bulleted list, numbered list, link, unlink, and other formatting options. The text area below the toolbar contains the message: 'Hi all, I think the graders might have made a mistake'.

Academic integrity

- Material challenging -> utilize teaching staff help. Otherwise, **homework assignments must be completed alone.**
- University policy is strict. Read the NCSU policy overview and Sections 8 and 9 of the Code of Student Conduct linked to the syllabus.
- Building fundamental skills in this class. Group work not allowed unless specified.
- Study groups can discuss code from in-class exercises, slides, and assigned reading, but not from homework.
- Not allowed:
 - Copying.
 - Talking someone through the solution.
- If you need more help go to office hours, Skype with TAs, or use private posts on the message board.
- Otherwise, the work you submit for homework must be entirely your own.

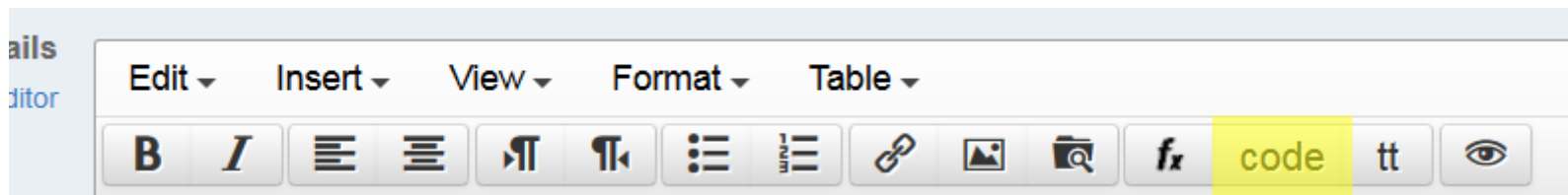
Message board (Piazza)

- Post Type: **question** or **note**
- Post To: **public** or **private** (to instructors)
- Select folder(s)
- Filtering and searching



Posting code questions on forums

- [how to create a minimal, complete, and verifiable example](#)
- make questions as specific and focused on one particular problem.
- post the error message and what you're trying to do.
- use the chapter where the homework question comes from.
- use the 'code' button to post code.
- enable students to discover mistakes.



Course schedule

- **1st Quarter**

Intro to Python basics, PythonWin development environment, data structures, ArcGIS API, decision making, looping

- **2nd Quarter** EXAM I project proposal

Batch processing, debugging, error handling, functions, cursors

- **3rd Quarter** updated proposal

Dictionaries, reading and writing text files, file GUI's, modules, classes, Mapping with Python

- **4th Quarter** EXAM II

Reading and writing HTML and KML, script tools, additional modules, project work

Software you need to install

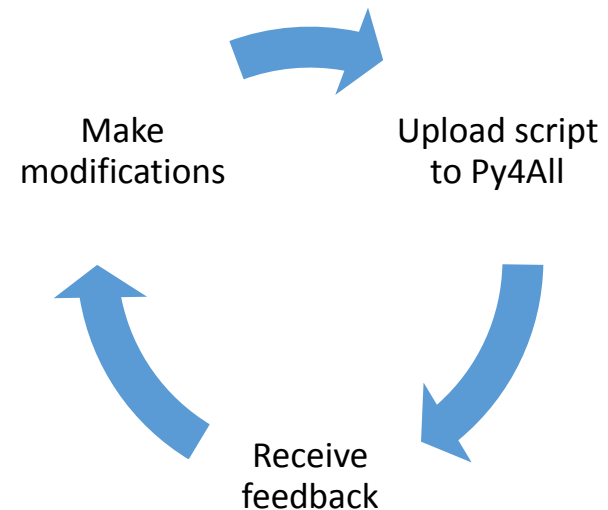
- ArcGIS
- Jing
- PythonWin
 - Python is automatically installed with ArcGIS
 - PythonWin is not.
- Test if PythonWin is installed correctly
 - Type this at the prompt in the PythonWin Interactive Window:
`import arcpy`
 - If you don't get an error message, you've got it.
- Pyscripter is another easy to install and use IDE has some advantages over PythonWin (e.g., tabbed script windows and immediate tab completion) but has a slightly steeper learning curve than PythonWin

Submitting homework scripts

- All deadlines are given in EST.
- Scripts should be named as specified.
- Put your unityID (e.g., jkrowlin) and name in each script.
- Don't zip submissions.

Py4All

- A tool designed to accompany the textbook, *Python for ArcGIS*
- How to use it:
 1. Watch the Intro to Py4All video
 2. Browse to go.ncsu.edu/py4all
 3. Login with your NCSU unity ID and password
 4. Upload a Python script for feedback.
- Can be used iteratively



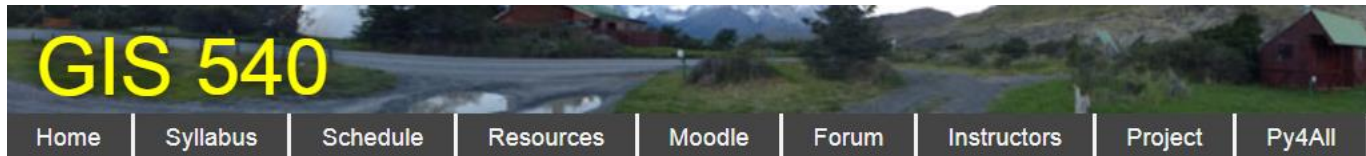
Course Website Tour

GIS 540

[Home](#)
[Syllabus](#)
[Schedule](#)
[Resources](#)
[Moodle](#)
[Forum](#)
[Instructors](#)
[Project](#)
[Py4All](#)

Day	Assigned reading	In-class exercises	Slides	Lectures	Related links	Quizzes
1 (08/23)	Ch 1: Introduction Ch 2.1-2.3: Beginning Python	In class	Intro to GIS540 Intro to Python	Lecture	Napquest -GP (10) -Building Models (10)	

Resources page



Data and sample scripts to accompany textbook: <http://go.ncsu.edu/gispy>

[Frequently Asked Questions](#)

[ArcGIS software download](#)

Arc10.* Resources:

[10.* Latest Desktop Help](#)

[10.* ArcGIS Forums](#) (ask for programming help)

-- [Python for ArcGIS sub-forum](#)

-- [Geoprocessing sub-forum](#)

-- [ArcObjects SDKs sub-forum](#) (Flex, REST, and javascript...)

Videos



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Meeting with instructors



Dr. Laura Tateosian, Research Assistant Professor
Center for Geospatial Analytics
Office: Jordan Hall 5110
lgateos@ncsu.edu
Phone: 919-515-3435

WebEx link: [GIS 540 Meeting](#)

Office Hours: By appointment.
[How to pronounce 'Tateosian'...](#)



TBA Teaching Assistant

Office Hours: By appointment (in person or Skype)



TBA Teaching Assistant

Office Hours: By appointment (in person or Skype)



Final Project



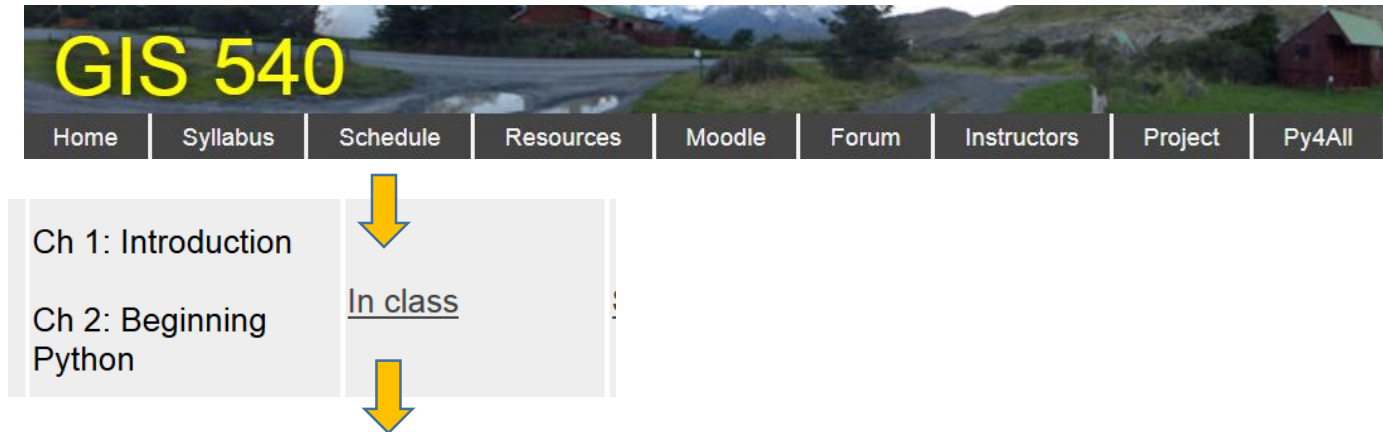
Links to examples and instructions

- [Project gallery \(examples from previous semesters\)](#)
- [Project Proposal Format and Evaluation](#)
- **[Final submission checklist](#)**
- [Final submission format](#)
- [Where to submit the final project](#)
- [How the project is graded](#)

Project requirements synopsis

For the project, you'll apply course topics to a geospatial application. Programming in Python.

In-class exercise



Simple buffer

To practice using sample data and sample scripts, try this simple example of calling an ArcGIS buffer tool, which generates buffers around the input features by following these steps:

1. If you don't have a C:/gispy directory, follow the instructions in the book to create it.
2. Confirm that C:/gispy/data/ch01/park.shp exists.
3. Launch ArcMap. Open the ArcGIS Python Window as shown in Figure 1.

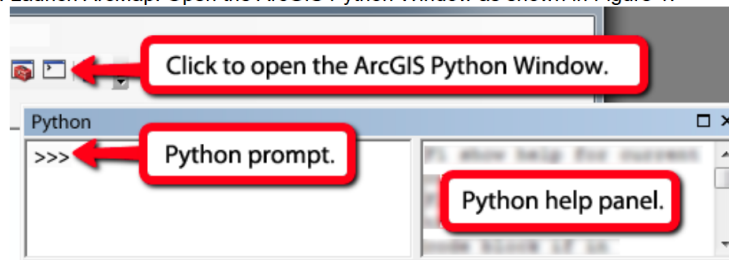


Figure 1: The ArcGIS Python window embedded in ArcMap.