WHAT YOU WILL LEARN

GIS PROGRAMMING FUNDAMENTALS (WITH PYTHON)

Dr. Tateosian
Center for Geospatial Analytics
North Carolina State University


OK-KUN


SWITZERLAND
FRANCE
GREATER GERMANY
ITALY
DEPORTATIONS FROM ITALY 1943–1944
Assembly Places
Deportations
German Ally
German-Occupied
Neutral

What do we hope to teach

1. The foundations of programming and Python syntax

2. Python access to ArcGIS.

3. Combine data processing and analysis to create a meaningful tool with an easy interface that eliminates tedious manual processing.

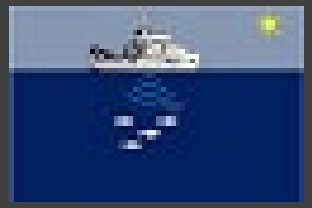
Course learning outcomes

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

Course project example



Data preparation for Generating NOAA Acoustic Trawl Survey Fish Species Biomass Estimates - Shannon Dolan

Input: NOAA acoustic trawl navigational and cluster csv tables.

Output: Cleaned daytime data for specific species, a map of the data, and an HTML page to show the result.

Recreational Aviation Navigation - Aaron Jones

Input: Departure and destination airports, operational range, planned altitude for the flight.

Output Flight map and HTML page including flight map plan and recommended stops.

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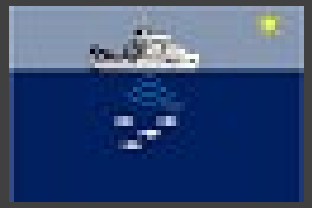

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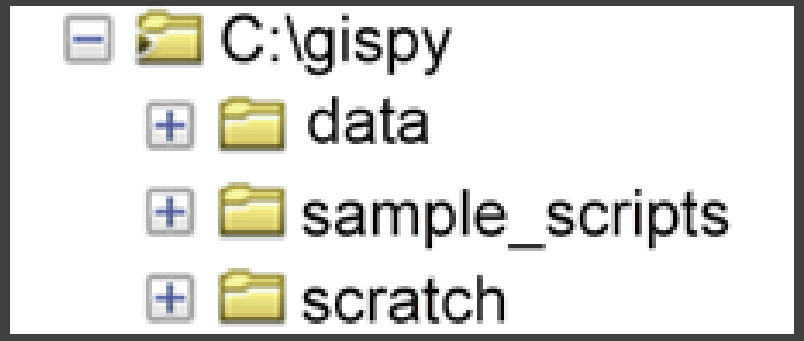
GRADING AND EXPECTATIONS

Textbook and data

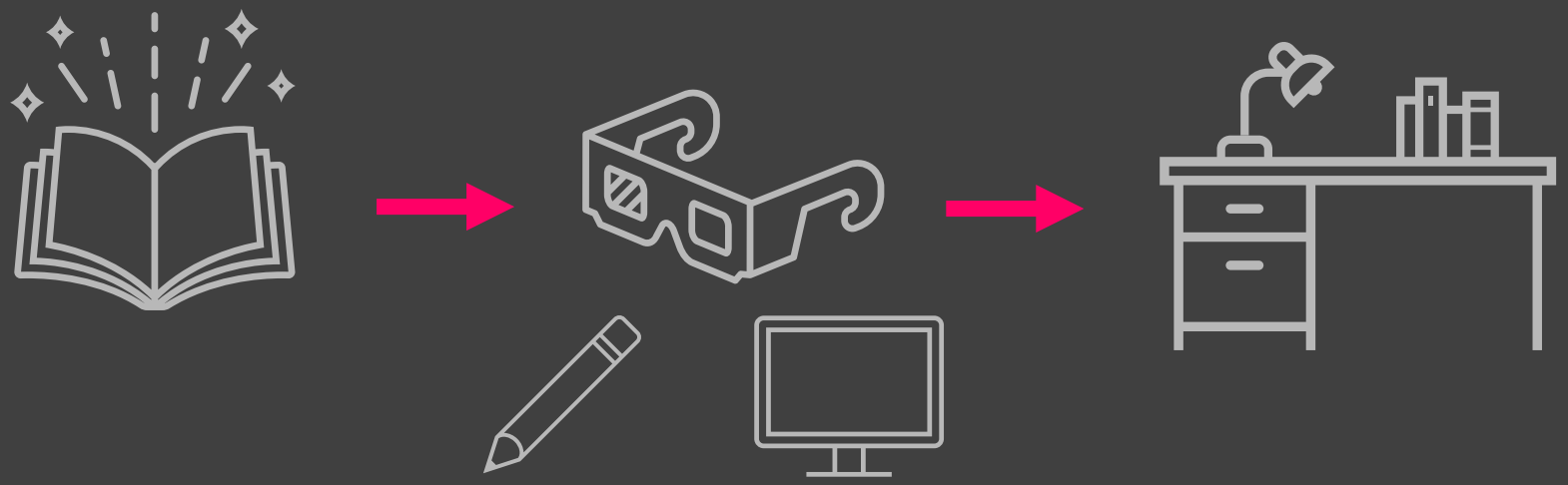
- *Required textbook:* Tateosian, Laura. *Python for ArcGIS*. Springer, 2015.
  - hard copy available for purchase
  - electronic version available for free to NCSU students (*pdf* recommended over eBook)
- Download the data and sample scripts from http://go.ncsu.edu/gispy



What to expect

“Although the lectures provided a nice introduction to the material, I definitely learned to code best by reading the textbook and working through assignments (I think this is just the nature of coding).”

--Anonymous student on course eval.



Put more in, expect more

GIS Cartographer Salaries

Job Title	Salary
Maps.com **GIS Cartographer salaries** - 1 **salaries** reported	$44,270/yr
Jeppesen **Cartographer/GIS salaries** - 1 **salaries** reported	$73,383/yr
DATA SOLUTIONS & TECHNOLOGY **Cartographer/GIS** Technician I **salaries** - 1 **salaries** reported	$51,826/yr

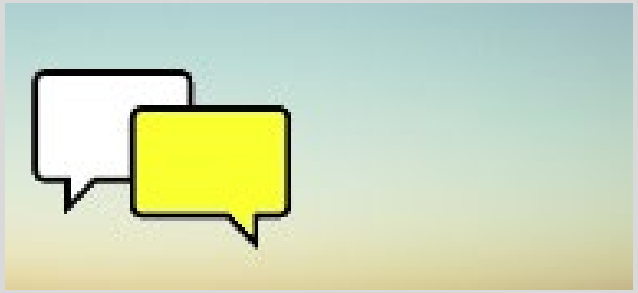
GIS Developer Salary

	Annual Salary
Top Earners	$147,000
75th Percentile	$124,500
Average	$110,411
25th Percentile	**$95,000**

30%

40%

25%



5%

Grading

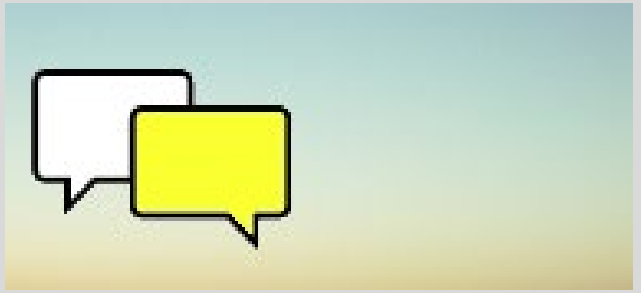
- 4-5 timed quizzes (30%)
- Homework (40%)
  - Python scripts (10 pts each)
  - Python tutorials (4 pts each)
  - Moodle exercises (~21 pts each)
- Project (25%)
- Participation (5%)
  - Piazza message board usage
  - Participation in help sessions
  - Lecture questions
  - Python notebooks

Grading

30%

40%

25%



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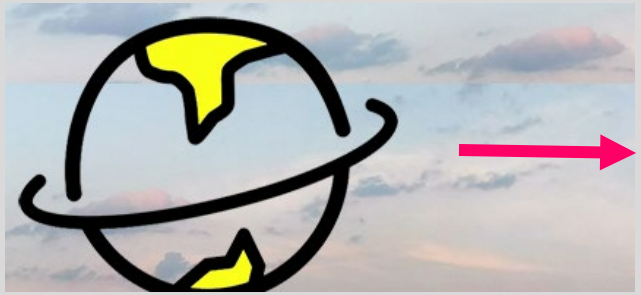

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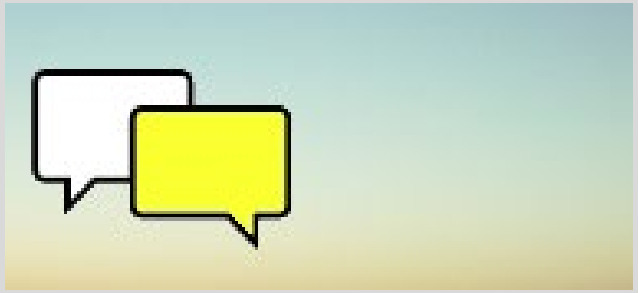

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Final Project Instructions

Stage 1: Preliminary project proposal (~week 10)

Feedback

Stage 2: Project progress (~week 13)

Feedback

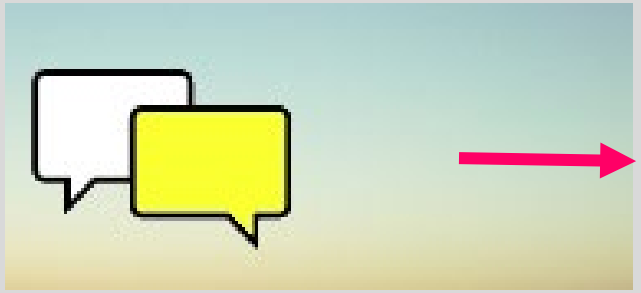
Stage 3: Final project submission (1st day of finals week)

Grading

30%

35%

25%



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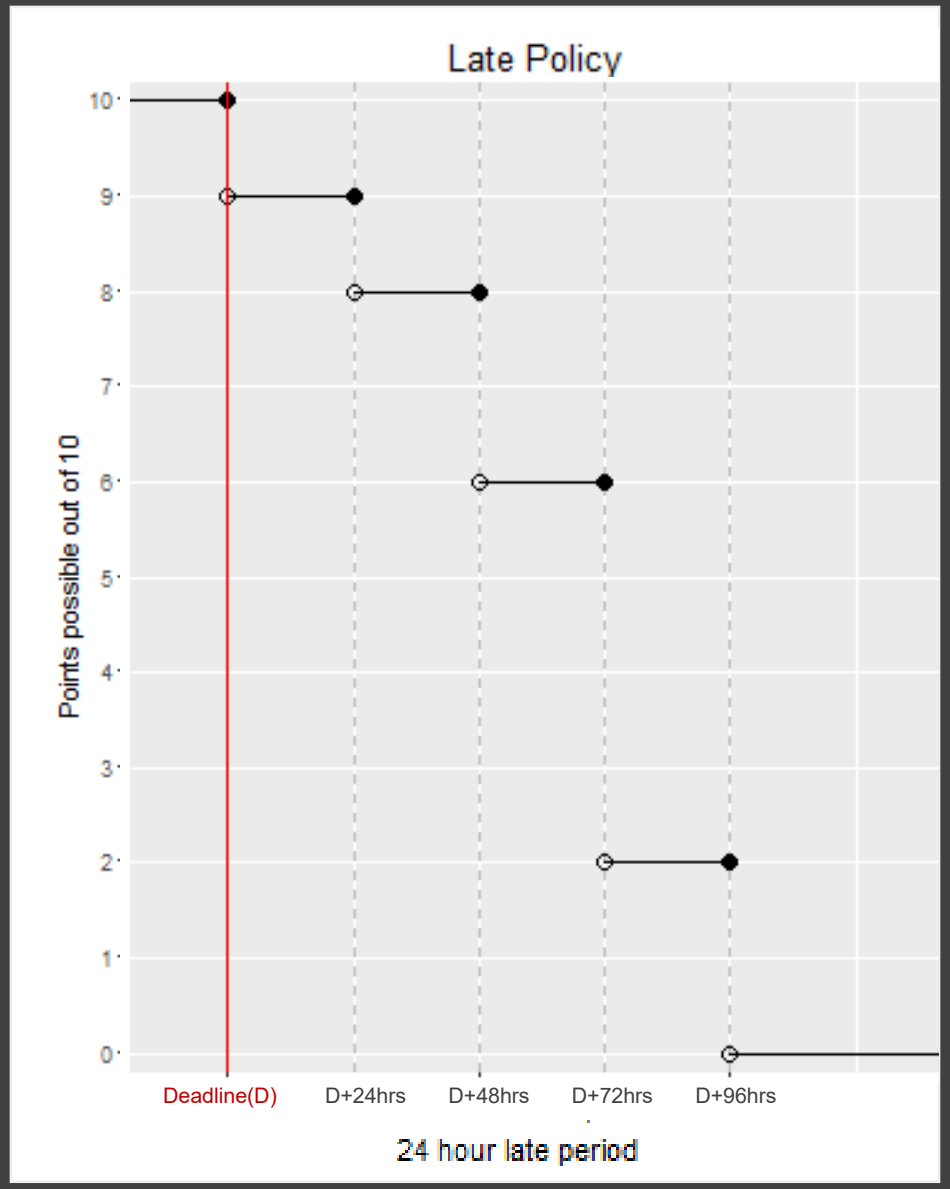
Late homework

penalty $=10*2^{(r-1)}\%$
where *r* is the number of 24-hour periods late.



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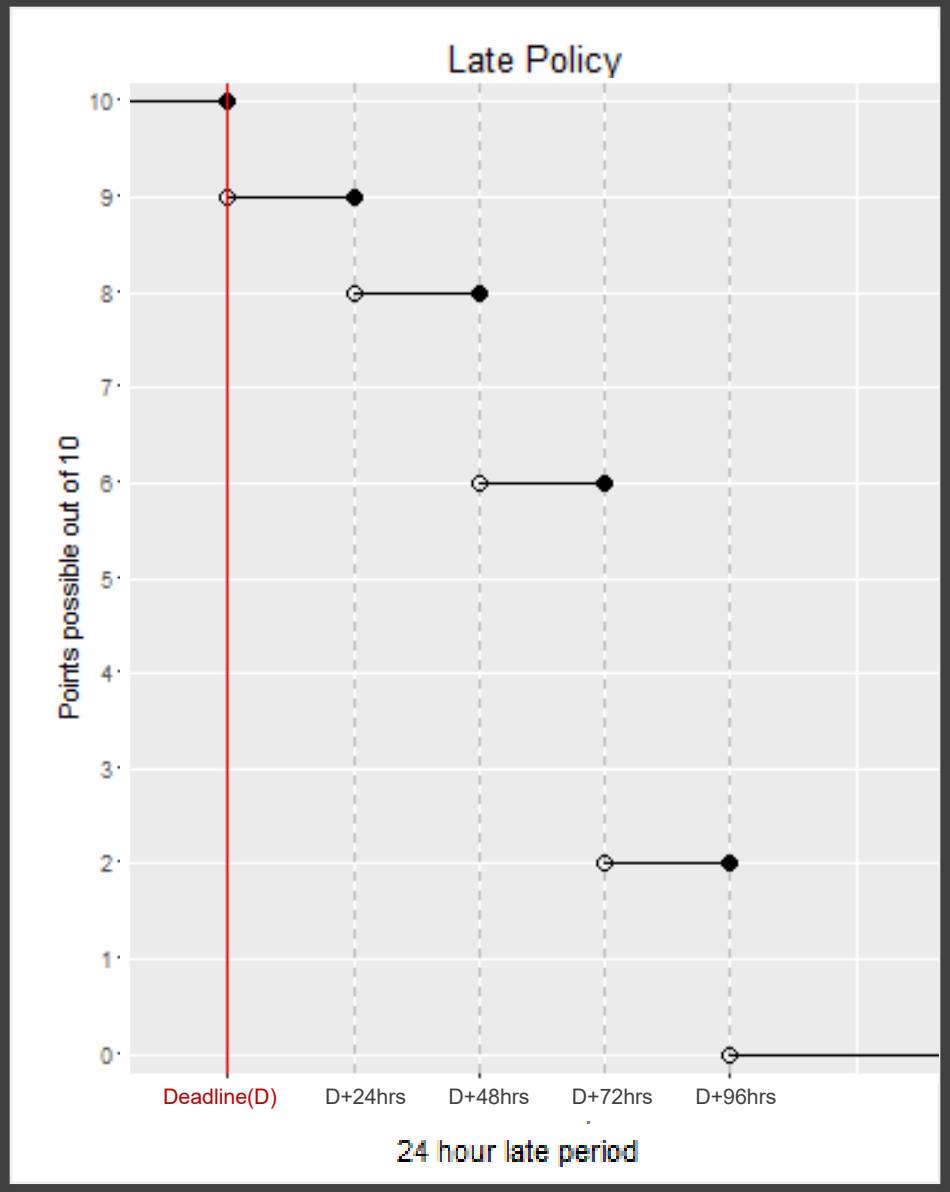
"Lateness" applies to each homework item separately.



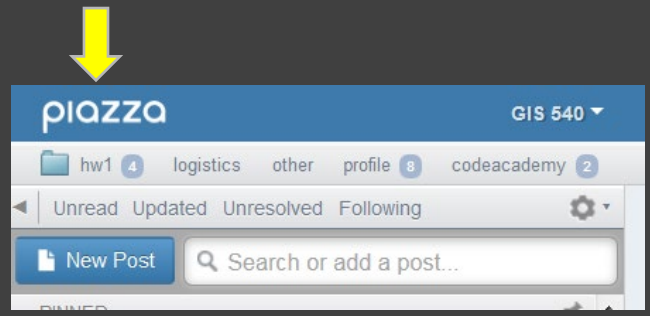
Academic integrity

- 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.

GETTING HELP

Message board (Piazza)

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



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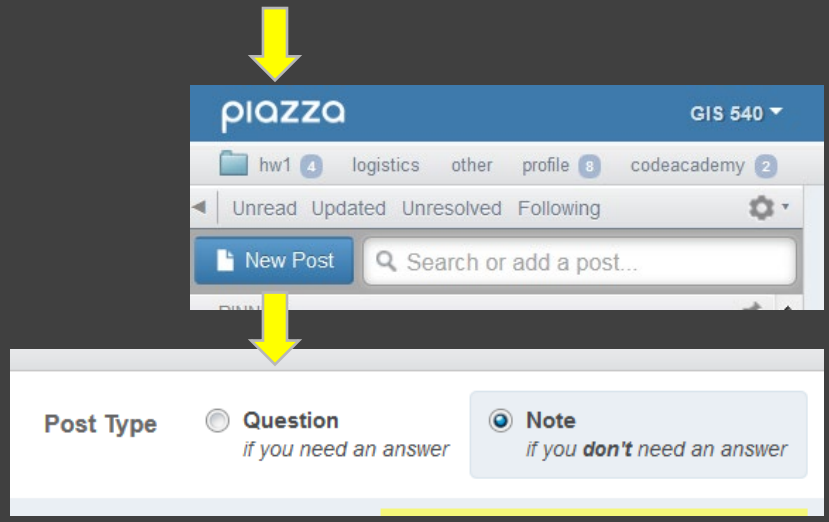

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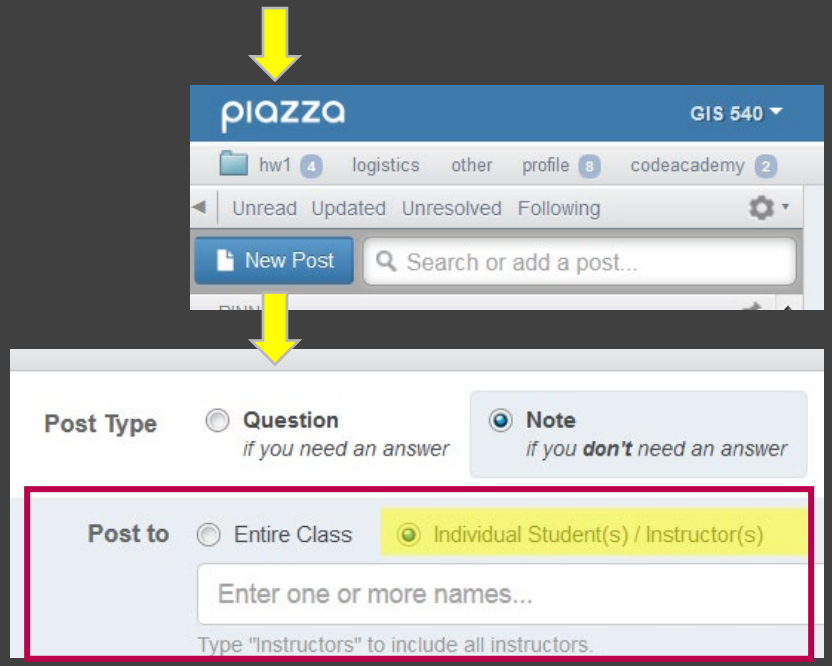

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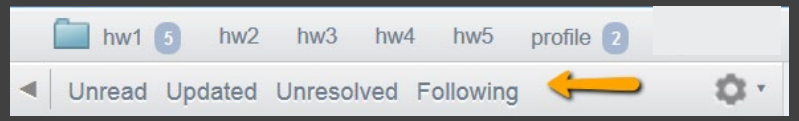

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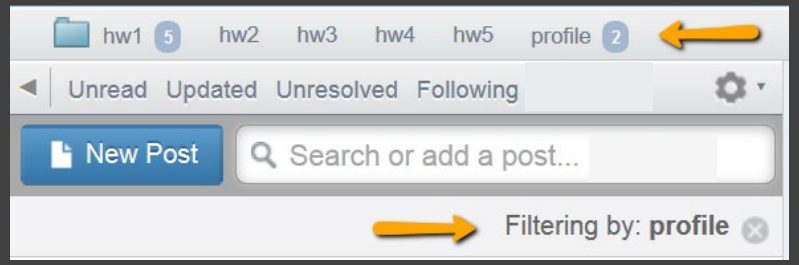

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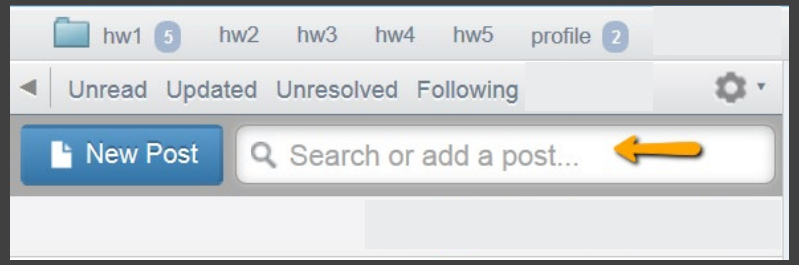
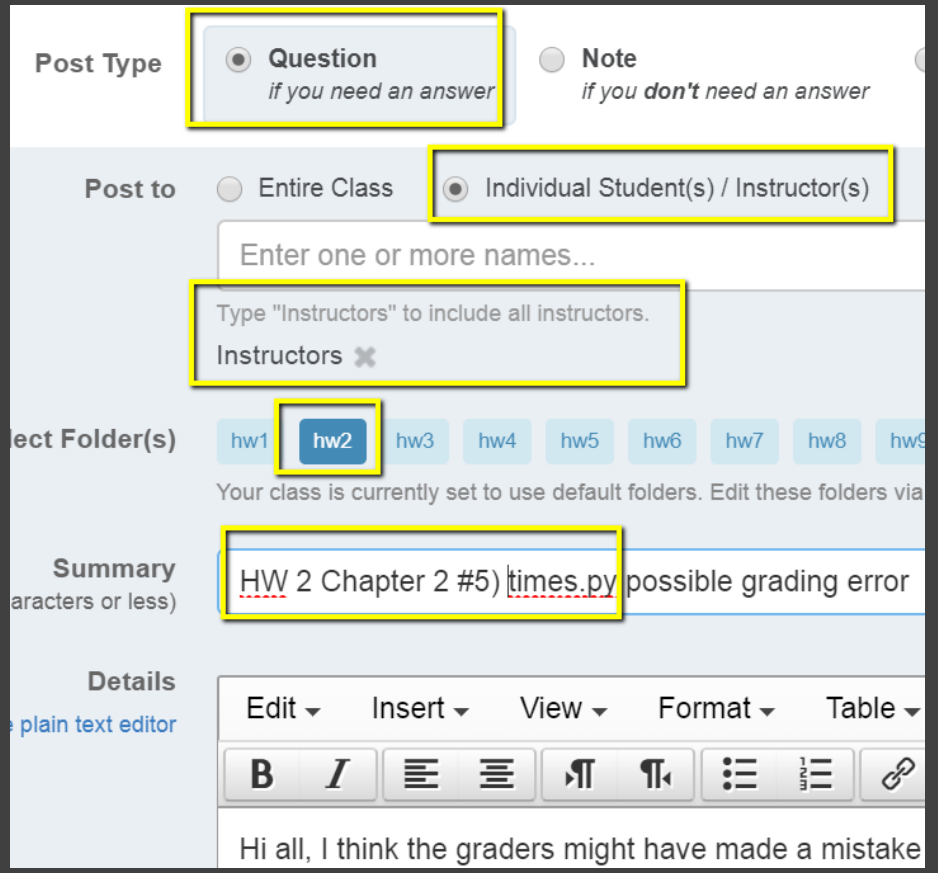


HELP!

Use the message board
Meet with instructors/TAs

Grade changes

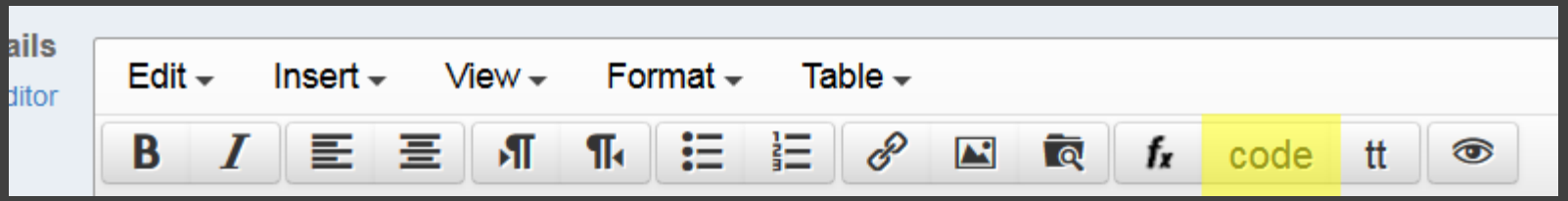
- Grades and comments posted in the Moodle gradebook.
- Grade change requests must be submitted within one week of being returned.



- 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.

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, integrated development environments, data structures, ArcGIS API, decision making, looping

- **2nd Quarter** 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**

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

SOFTWARE

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.

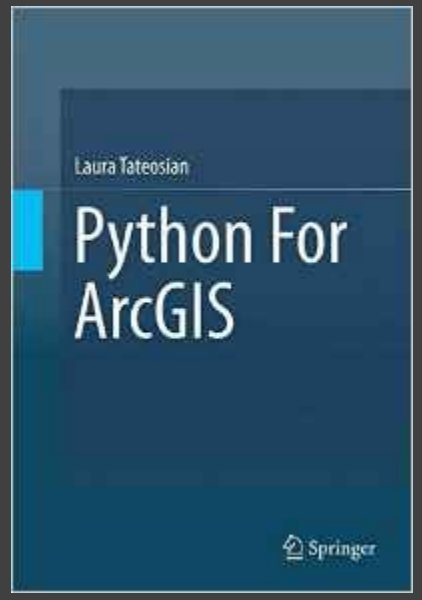
ESSENTIAL RESOURCES

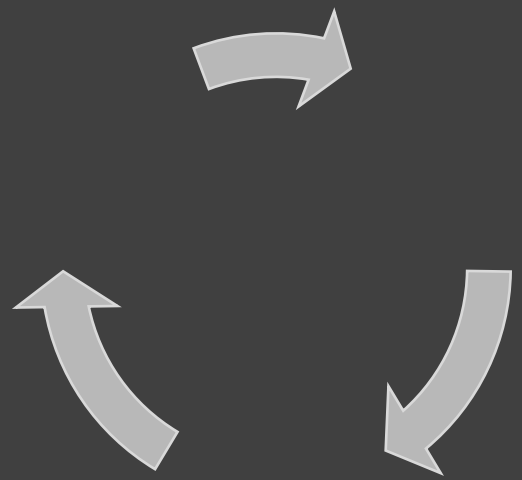
Py4All

- 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





Essential Resources

- Announcements ("FOLLOW" THESE)
  - General news and announcements will be posted here.
- Syllabus
  - Guidelines, expectations, and responsibilities for GIS540 participants.
- Piazza message board
  - Post your questions or comments (see the how-to) regarding assignments, software issues, and coding challenges here.
- Instructors (a.k.a. Meet the instructor)
  - Professor and Teaching Assistant names, photos, and office hour arrangements.
- Py4All
  - upload textbook exercise scripts to receive automated feedback, compare your output to the solution output, and use this information to improve the script prior to submitting it for a grade.
- gispy.zip
  - the data and sample scripts to accompany textbook
- Course project
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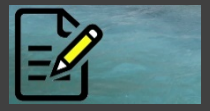
Schedule

- Week blocks
  - Topic 1
    - Readings
    - Videos
    - Slides
    - In-class exercises
  - Topic 2
    - Readings
    - Videos
    - …



Homework blocks

Quiz blocks

- Links to the quiz

READ AGAIN → TRY IT

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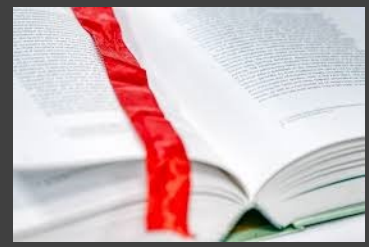

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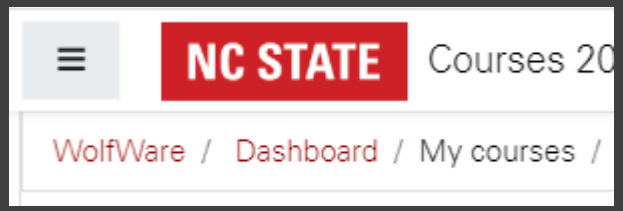
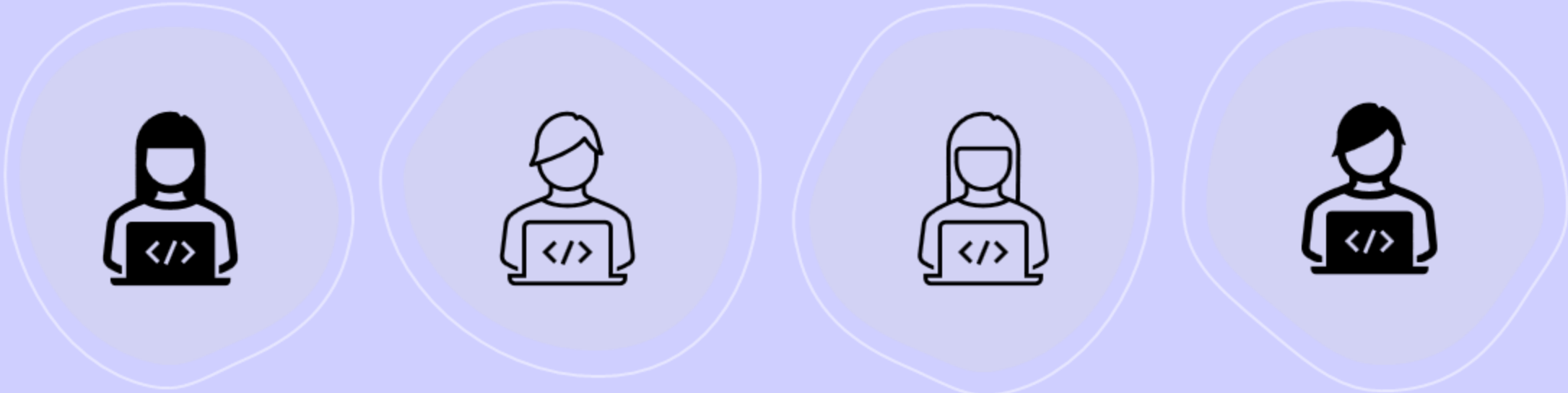
  - Post your questions or comments (see the how-to) regarding assignments, software issues, and coding challenges here.
- Instructors (a.k.a. Meet the instructor)
  - Professor and Teaching Assistant names, photos, and office hour arrangements.
- Py4All
  - upload textbook exercise scripts to receive automated feedback, compare your output to the solution output, and use this information to improve the script prior to submitting it for a grade.
- gispy.zip
  - the data and sample scripts to accompany textbook
- Course project
- Gradebook
- Schedule Overview

Moodle navigation

Click the hamburger to expand or collapse the navigation bands on the left –hand side.

“hamburger”





Hello world!

GIS 540 Geospatial Programming Fundamentals

Course Participants Grades

Essential Resources

Course ZOOM Link | Announcements | Syllabus | Py4All code checker

Course project instructions | Data & scripts (gispy.zip) | Schedule overview

HELP! PIAZZA MESSAGE BOARD (using Moodle login)

Software you need to install

- ArcGIS Pro
- DO NOT install Python (it is already installed with ArcGIS)
- 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.
- PyCharm is another easy IDE has some advantages over PythonWin (e.g., tabbed script windows and immediate tab completion) but has a steeper learning curve than PythonWin
- VS Code
  - We will use this to run Python notebooks when we run them outside of ArcGIS Pro