GIS Programming (1)

GIS 400/500

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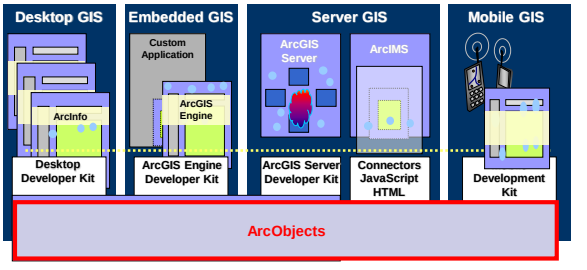
Outline

- Course goals
- Why GIS programming
- Syllabus

Goals

- Learning how to do programming in GIS. This is a specific goal that should help you to utilize GIS more efficiently;
- Learning basic **Object Oriented** analysis, design, and programming skills. This ability could assist you throughout your career (academic or industry)

ArcGIS developer kits



Reason for customizing GIS

- Available GIS software are for common purposes only
- automate simple repetitive tasks
- streamline your work flow
- create new functionality
- produce third party solutions and add-ons to ArcGIS
- Provide spatial solutions to non-GIS users
- …

Other general tasks

- Reproject 100 files from Lan/Lon to UTM
- Add all the data in a folder with one click
- Build a simplified map interface for field foresters
- ….

Top five skills needed to have a successful GIS career

- From Adena Schutzberg
  - Teach yourself new procedures/workflows/software
  - Work in a team
  - Act (research/read/learn/explore/contribute) based on your curiosity/responsibility
  - Find a/several mentor(s)
  - Confidently communicate orally, in writing, in graphic form, in front of an audience, on video, via Twitter, etc.
- From Joe Francica

  Three Basic Skills
  - Programmatic skills, Problem solving skills, Spatial thinking skills

  Two Advanced Skills
  - Be an expert in one specific discipline, Communication skills are essential

http://www.directionsmag.com/articles/the-top-five-skills-needed-to-have-a-successful-gis-career/199099 (published 9.13.2011)

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Programmatic skills

- Prepare your mind for spatial thinking – take a course in basic computer programming. Programming prepares your mind for logical thinking; it prepares you to think through a process that provides an end result. Structured query language (SQL) provides the syntax that underpins spatial queries so that the geospatial analyst can think through the process of creating and producing the expected outcome. That outcome is a map that provides the analyst with a spatial perspective that reveals geospatial information.

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Syllabus

- Tentative course calendar

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Lab

- In room 102
- Work on your own

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Office hours

- Tuesday 1:00pm -3:30pm
- Wednesday 8:30am-12:00pm,
  1:00pm–5:00pm
- Or by appointment

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Syllabus

- Lab
  - 10 labs, no group work (0 credit for all the parties if copy each other's work)
  - Late lab will lose 20% of the credit each day late.
- Term project
  - At most 2 students a group
- Grade

MIDTERM EXAM		250
QUIZZES	(20 x 5)	100
TERM PROJECT		250
LAB ASSIGNMENTS	(40 x 10)	400
TOTAL POINTS		1000

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Interview questions

- From Amazon, Microsoft, Yelp, Google, Groupon…
  - Given a dictionary and a string. Write a function, if every word is in the dictionary return true, otherwise return false.
  - Generate all the permutation of a string. For example, abc, acb, cba, …

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Grading policy

- Questions regarding lab/homework/quiz/exam grading must be asked within one week after the lab/homework/quiz/exam is returned.

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Textbook

- Optional
  - Paul A. Zandbergen 2013, Python scripting for ArcGIS, ESRI Press, ISBN 978-1-58948-282-1

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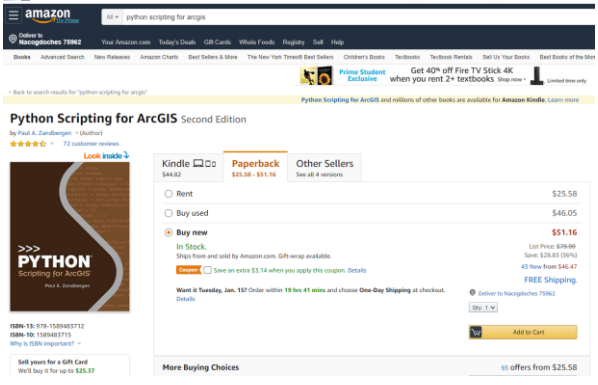

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Problems

- The difference between general GIS and programming
  - Think as computer
- Lab solutions are provided directly to students
  - In this class, practice is more important than learning ArcMap
- PythonWin is used throughout the book

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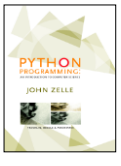
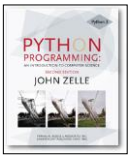
Python reference books 1

- Python Programming: An Introduction to Computer Science, by John M. Zelle



First Edition (Python 2.x)



Second Edition (Python 3.x)

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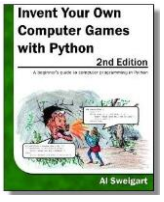
Python reference books 1

- Invent your own computer games with Python, by Al Sweigart
- Free pdf is available at http://inventwithpython.com/index.html



GIS400/500

- Two courses combination
  - Programming
  - GIS programming

Good or bad?

Tao of programming 1

by Charles Severance, author of using Google App Engine

- In the first phase, you hate the computer and you hate Python. It seems that no matter what you do, Python always tells you "Syntax error" or "Traceback." You read the book, and try to get things right and gingerly hand a bit of code to Python. Python seems to dislike you personally and nearly always rejects your submission as "not worthy". You start to feel like an insignificant worm that Python hates and rejects your "almost perfect" submissions no matter how hard you try. Sadly, many people get to this point in their first programming class, give up, and vow to choose a career that is as far from technology as possible.

Tao of programming 2

- In the second phase, you realize that when Python is telling you "Syntax error" or "Traceback", it means that Python has become confused and does not know what to do next. Python is kind of like a puppy. A puppy will listen to whatever you say and seem interested in everything you are saying but a puppy only understands a few words like "food", "fetch", "sit", or "walk". In the second phase, you begin to feel superior. You realize that when Python gives you an error, Python shows that it needs to keep coming to you for help and guidance and purpose. Python is nothing without you. You are the wise and powerful programmer. Sometimes you write a loop to make Python sum up all the numbers between one and a million just to show it who is boss.

Tao of programming 3

- In the third phase, you realize that Python is actually a great help to you and that Python represents the collective intelligence of hundreds of programmers who have given you some powerful and brilliant tools and capabilities. When you face a problem, you are not alone -- you are facing the problem with the programmers who built Python at your side. All you need to do is use the right bits of Python and combine them to solve your particular problem. Sometimes when you are in a hurry, your instructions have a little mistake. When you make a mistake, Python courteously gives you an error message that includes clues as to what Python thinks you have done wrong. After a while, you will be able to quickly look at the error messages and have the clues jump out at you so that you can fix the tiny mistake you have made. You and Python are partners who help each other along the way.

How to be successful ?

- Most difficult GIS course, if no programming experience
- A.T.M.P.
  - Attend class
    - Actively practice (writing code)
  - Take notes
  - Memorize and understand
    - Too much information
  - Practice, practice, and practice.

GIS programming

1. Separate yourself from the pack when trying to land a job. There is a huge demand for GIS developers and a minuscule supply. Many of the higher paying positions in GIS require an understanding of one or more programming languages so do yourself a favor and start learning now!
2. Expand your capabilities and value within your organization
3. Skills you learn are transferrable to other software. For example, once you learn how to program with Python it can be used with ArcGIS, QGIS, and other open source tools such as GDAL, Shapefly and others. JavaScript is used with ArcGIS Server, OpenLayers, Google Maps, CartoDB, and many others.
4. Automate your monotonous, repetitive geoprocessing tasks
5. Languages like Python are relatively easy to learn so why not? The time you invest in learning Python or JavaScript is well worth the effort..

Reference: GeoSpatial Training Services

Summary

- Course goals
- ArcGIS family
- Why GIS programming?
  - Intellectually challenging
  - GIS career
  - Manage projects that involve software
  - Program for mobile devices
- Syllabus