Introduction to Programming

Matthew X. Curinga

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**Computer Science 0145-602, Fall 2022**

**Keywords:** computer programming, CS1, python, computational thinking, critical computational literacy, jupyter, data science

**Description:** This course introduces students to programming and core concepts of computer science, using a modern, object oriented programming language (currently Python). Students learn concepts of variables, functions, repetition/loops, basic data structures (arrays, lists, dictionaries), and basic object oriented programming.

**Class meetings:** Online, asynchronous (coordinated through Moodle)

**Instructor**

* [Matthew X. Curinga](http://matt.curinga.com), [mcuringa@adelphi.edu](mailto:mcuringa@adelphi.edu)

**Dr. Curinga’s Office Hours by appointment**

* Wednesday, 4:30-5:30PM
* Thursday, 4-5PM

# Learning Goals

* understand the types of problems that can be solved using computational techniques
* understand the basic concepts of computation (CPU, RAM, permanent storage, GUIs, file systems, network connections)
* learn core computer programming concepts (abstraction, variables, conditions, functions, repetition, recursion)
* think algorithmically to design and test computer programs
* master the basic syntax and idioms of the Python programming language
* use technical documentation, APIs, and the internet to learn new technical concepts
* develop step-by-step problem solving and debugging practices

# Required Software

For this class we will be programming in the [Python](https://python.org) programming language, using a development platform called [Jupyter Notebook](https://jupyter.org/).

You will be writing your code through a web-based version of Jupyter called Jupyter Hub. You will have to create an account on our Jupyter Hub by going to <https://data.mixi.nyc> and joining using your Adelphi student email.

# Required Text

*Our textbook is free, open source, and available online. There are links below to the “standard” version and an interactive version which includes live code examples and comprehension questions. You may read either or both or switch between them, depending on your preference.*

Downey, A. B. (2016). [*Think Python: How to Think Like a Computer Scientist, Version 2.4.0*](http://greenteapress.com/thinkpython2/html/index.html). Green Tea Press.

Miller, B. & Ranum, D. (n.d.) Based on work by Jeffrey Elkner, Allen B. Downey, and Chris Meyers. [*How to Think Like a Computer Scientist: Interactive Edition*](https://runestone.academy/ns/books/published/thinkcspy/index.html)

# Reference Materials

*Consult this documentation as needed.*

* [[Jupyter Lab](https://jupyterlab.readthedocs.io/en/stable/user/interface.html)] our software development environment
* [[Python Documentation](https://www.python.org/doc/)] official python language docs
  + [[tutorial](https://docs.python.org/3/tutorial/index.html)] basic tutorials
  + [[library reference](https://docs.python.org/3/library/index.html)] reference of the standard libraries
  + [[style guide](https://peps.python.org/pep-0008/)] naming variables, spaces, quotations, comments, etc.

# Class meetings

This is a fully asynchronous online class, which will run on a Monday-Monday schedule, meaning new topics will begin each Monday, and quizzes will be due by end of day on Sunday. There are no set meeting times, and there will not be Zoom or other video class sessions. You will be able to flexibly schedule your time within the week for each topic.

### Weekly topics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Week | Date | Topic | Read | Due |
| 1 | Aug 29 | The way of the program | TIP 1 | Quiz 0 |
| 2 | Sep 05 | Variables & Statements | TIP 2 | Quiz 1 |
| 3 | Sep 12 | Functions | TIP 3 | Quiz 2 |
| 4 | Sep 19 | Conditionals & Recursion | TIP 5 | Quiz 3 |
| 5 | Sep 23 | Fruitful Functions | TIP 6 | Quiz 4 |
| 6 | Oct 01 | Function Review | - | Quiz 5 |
| 7 | Oct 10 | Iteration | TIP 7 | Quiz 6 |
| 8 | Oct 17 | Strings | TIP 8 | Quiz 7 |
| 9 | Oct 24 | Lists | TIP 10 | Quiz 8 |
| 10 | Oct 31 | Strings & Lists | - | Quiz 9 |
| 11 | Nov 07 | Dictionaries | TIP 11 | Quiz 9 |
| 12 | Nov 14 | Tuples & Files | TIP 12 | Quiz 10 |
| 13 | Nov 21 | Content Analysis | - | - |
| 14 | Nov 28 | Visualizing data | - | Project Thesis & Team |
| 15 | Dec 05 | Group Meeting | - | - |
| 16 | Dec 12 | Final Projects | - | **Final Project** |

TIP: *Thinking in Python*

### Live labs

In addition to the required weekly assignments, there will be several “live” labs on Wednesdays (4:30-5:30). These live **sessions are optional**, but will offer additional help and hands-on demonstration of course concepts.

### Tutoring

The Adelphi Learning Center offers [individual and group tutoring](https://www.adelphi.edu/learning-writing-centers/tutoring/), which can be either in person or online, scheduled through their website. This is an excellent, free service and you might want to schedule a session to go over some of the labs. In addition, Math and Computer Science has free, drop-in tutoring sessions on weekday afternoons in the Garden City campus. They may also post some Zoom sessions. I will post the schedule and details on the course website after the semester starts.

# Assignments and Grading

|  |  |
| --- | --- |
| Assignment | Pct |
| Quizzes | 60% |
| Final Project | 40% |

## Lab Exercises

Most weeks there will be ungraded lab exercises where students can practice the new materials covered. In general, you should spend about one hour working on these exercises. If you understand the exercises, you will be on track with the course. There may be bonus problems that are a little bit more challenging, which are optional. You are encouraged to work on the exercises with other students and friends. You are not asked to turn in lab assignments.

## Quizzes

Quizzes will consist of 1-3 questions, similar to the lab exercises. Each quiz is worth a total of 6 points. Earlier in the semester, the quizzes will have up to 6 questions each, with multiple choice and short answer questions. After we develop more skills writing code, quizzes will consist of a single question and you will copy-paste your solution or upload your source code to Moodle.

Quizzes will be timed, taken through Moodle. If you have already worked throug the lab problems, quiz problems are designed to take approximately 30-40 minutes to complete. You will have 90 minutes once you begin the quiz to submit your answers. Before you attempt the quiz, make sure that you are ready to proceed – you will not be able to pause the quiz once it begins. You can use the textbook, course examples, and any documentation or internet resources you find. **You may not ask other people for help.** While programming is a highly collaborative practice, these quizzes are meant to assess *your* work and understanding.

## Final Project: Data Analysis

During the course of the semester we will be learning about the software design process, and have the opportunity to write a larger program for this final project. The final project is a group project, and you should work in a group of 2-4 students.

You will choose to do either a *content analysis* project working with a corpus of text data, *or* a data analysis project working with quantitative data from the New York City public schools open data set.

Content Analysis is a research approach that uses statistical methods to analyze textual data. The skills we develop in this first semester of programming will be enough to allow us to conduct our own, novel content analysis research. We will be focusing on the analysis of textual data, with examples looking at the content found in works of literature, song lyrics, and in political speeches.

Python is an excellent programming language for *data science*, and we will learn some of the basic techniques of data science with python while looking at data about New York City schools, including demographic information, State test scores, regents scores, etc.

Your team will choose a single topic and coordinate (through sharing code on our Jupyter Hub) on the final project. To submit this project you will turn your finished Jupyter Notebook which includes both the code and the formatted output, as well as a short team video (5-8 minutes) where each team member describes a key aspect of the software that they worked on.

### Final Project Grading:

1. **Concept & Design** (*5 points*)  
   Does the project demonstrate a good match between the type of question you explore and the type of answers that computer analysis can provide?
2. **Coding fundamentals** (*20 points*)  
   The program demonstrates a grasp of the programming concepts covered in this class, including:
   * *variables*
     + data is not “hard coded” and can be easily changed by using variables, soliciting user input, and/or reading from files
     + data is separate from functionality
   * *functions*
     + abstraction through function parameters
     + encapsulation through function parameters and return statements; use “pure functions” with zero-side effects when possible
     + composition and re-use of code
   * *design*
     + the program is organized through the use of functions
     + functions’ “scale” is appropriate to the task and discrete: concerns are separated logically, such as one function for gathering results and another for outputting results
     + functions are written in a way that they are used several times in the program
     + code is not repeated
   * *data structures*
     + use python built-in data structures appropriately: list, dict, tuple, set, etc
     + use index/slice notation if needed
     + sort data structures
     + map, filter data as needed
   * *style*
     + is the code style consistent throughout the program?
     + does the code adhere to the style conventions discussed in our readings?
     + are variables and functions named in a clear way?
     + are comments and docstrings included to clarify the program?
   * *testing*
     + does the program include test functions to ensure the program is working as expected?

* Each team member will receive an individual grade for this portion of the project.

1. **Risk Taking** (*5 points*)  
   How “adventurous” is this project? Does the team show that they move beyond the template given to them? Do they come up with a really novel and desirable project? “Riskier” project push beyond the material strictly covered in class and demonstrate the teams’ ability to learn new things and push their horizons.
2. **Results** (*10 points*)  
   How well does the program achieve its goals? Are the results clearly presented in the Notebook file?