Information Structures with Python

MET CS521 A2 SPRG23 (Tuesdays, 6PM)

Bld FLR Rm 152 | Office hours: Tuesdays 5-6pm | Course Website: https://learn.bu.edu/
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Table of Contents

Course Description

This course presents a practical approach to learning Python. With extensive use of graphical illustrations, it will build an understanding of Python and its capabilities by learning through many simple examples and analogies. The class will involve active student participation, discussions, and programming exercises. This approach will help build a strong foundation in Python programming that can be used effectively in real-job situations and future courses.

Prerequisites: Familiarity with at least one programming language. Understanding of key language constructs and methods. Ability to formulate quantitative information symbolically and numerically.

Learning Objectives

By successfully completing this course students will be able to:

- Use Python programming language constructs to implement a variety of analytical and computational methods (searching and sorting)
- Explain tradeoffs between different Python methods and data structures in computation
- Apply acquired skills in diverse settings by completing a course project of their choosing
- Present both symbolic and visual results their course project
- Articulate the advantages and limitations of using Python

To accomplish this goal, course materials are divided into a set of mini modules corresponding to particular topic(s). These mini modules will typically include the following:

- Course material with many examples
- Self-test questions
- Sample programming problems including typical Python job interview questions (collected from various sources on the internet)

Textbook

Contemporary programming languages like Python enjoy rich online documentation. Indeed, they are built on the premise that programmers are continually in contact with such documentation and are not expected to memorize any but a small fraction of it. The textbook for the course is below. There will be readings from the text weekly.

- **Punch, W. and Enbody, R. (2016). The Practice of Computing Using Python (3rd ed.). Pearson. ISBN-13: 978-0-13-437976-0.**

This book can be purchased from Barnes and Noble at Boston University. An e-book is available at Vitalsource.com. An e-book is available through the BU bookstore.

Note: You do not need to purchase the textbook "with access," also referred to as the "lab" portion of this text. It will not be used in this course.

Additional Resources

There are many online resources available. This is a partial list:

- http://www.pythontutor.com/visualize.html - this website is very useful and allows to run simple Python programs and visualize the execution. Many of the illustrations in the course notes were generated using this website.
- https://docs.python.org/2/tutorial - an official Python tutorial
- https://www.tutorialspoint.com/python - a detailed tutorial with many simple examples
- https://www.learnpython.org - free, interactive tutorial
- https://www.python.org/community/sigs/current/edu-sig/ - contains links to learning resources, including two free books

Running Python Programs

We will be using Spyder IDE (Integrated Development Environment) and Anaconda Python Distribution. We have these installed in our virtual lab. MET Virtual Labs (VLAB) provide students with all required software. Most of the examples presented in class will be run in this environment. You can familiarize yourself with the virtual labs with the information from our website: https://www.bu.edu/metit/services/client-technology/virtual-lab/

Grading Information

Please check the Calendar in the Syllabus for class dates and due dates for assignments and assessments.

Teaching Approach and Goals

This course promotes and believes in learning by using many illustrated examples. These examples will help us build the fundamental understanding of Python and how to use it to solve real problems. Many exercises presented in the course will help you develop skills that are needed to use Python effectively in your workplace and more advanced courses.

Grading Criteria

The course grade will be based on

- Class participation (5%)
- Quizzes (20%)
- Assignments (25%)
- Final project (20%)
- Final exam (30%)

Assignments are expected to be submitted by their respective due dates. Late submissions are not accepted.

- **Assignment Completion & Late Work** – all the assignment must be submitted in person or electronically on Blackboard. **No late work** will be acceptable.
- **Laptop Requirement –** Students should have a personal laptop. We will use laptops in classroom to write Python programs. You will need a laptop in quizzes and the final exam as well. Please have your laptop **FULLY CHARGED** before coming to the classroom every Tuesday!
- **Academic Conduct Code** – Cheating and plagiarism will not be tolerated in any Metropolitan College course. They will result in no credit for the assignment or examination and may lead to disciplinary actions. Please take the time to review the Student Academic Conduct Code: http://www.bu.edu/met/metropolitan_college_people/student/resources/conduct/code.html.

Homework Assignments

There will be **6 Module Homework Assignments**, assigned 1 week before the due date and due 1 hour before 6 corresponding Module Quizzes. This is a programming class, and it is essential that students have practice. Most homework assignments will consist of programming problems from the textbook.

Quizzes

- There will be **6 30-minute Module Quizzes of multiple-choice questions.** Quizzes are closed book and will consist of typical Python questions that one can expect at a job interview. Students should ensure adequate preparation before starting the quiz. Please note that it won't be possible to do well on the quizzes without reviewing the course materials.
- There will be **Weekly Short Quizzes** at the beginning of the class time (except for the 6 weeks of Module Quizzes), and **In-Classroom Practices** which will be submitted at the end of the class time.

Project

The project is open ended and the topics can be chosen by students. In this project, students will frame and solve problems using quantitative capabilities of Python. Students will present their projects in the final week of the course.

Final Examination

will be closed book and will take two hours. The exam will consist of typical Python questions that one can expect at a job interview.

Study Guide

Module 1: Introduction to Computing with Python

Readings:
- Chapter 1 (pp. 37-53), Chapter 9 (pp. 456-463), and Appendix A
- Module Lecture Notes

Topics:
- Introduction to Computing, Program Structure, Running Python, Input/Output, Variable Scopes, and Modules

Assignments Assignment 1

Assessments Quiz 1

Module 2: Basic Building Blocks for Python Programs

Readings:
- Chapter 1 (pp. 37-53), Chapter 9 (pp. 456-463), and Appendix A
- Module Lecture Notes

Topics:
- Data Types, Hashing, Mutability, Python Ranges, Copying Objects

Assignments Assignment 2

Assessments Quiz 2

Module 3: Building Python Projects

Readings:
- Chapter 2 (pp. 122-140), Chapter 4, Chapter 6 (pp. 271-276), Chapter 14 (pp. 645-665)
- Module Lecture Notes

Topics:
- Strings, Collections, Control Flow, Iterations, Files, Lists

Assignments Assignment 3
Assessments Quiz 3

Module 4: Collections in Detail

Readings:
- Chapter 7 and Chapter 9
- Module Lecture Notes

Topics:
- Sets, Tuples, Dictionaries, Stacks, Queues, Singly Linked Lists, Doubly Linked Lists, Sorting, Searching

Assignments Assignment 4
Assessments Quiz 4

Module 5: Functions in Detail

Readings:
- Chapter 6 (pp. 282-285), Chapter 14 (pp. 667-672), Chapter 5, Chapter 8, Chapter 15, and Chapter 16 (pp. 724-736)
- Module Lecture Notes

Topics:
- Exceptions, Introduction to Functions, Parameter Passing, Generators, Recursive Functions, Functional Programming

Assignments Assignment 5
Assessments Quiz 5

Module 6: Classes in Detail

Readings:
- Chapters 11, 12, and 13
- Module Lecture Notes

Topics:
- Introduction to Classes, Assignment and Copy, Static vs. Instance Variables, Data Encapsulation, Overloading, Inheritance and Polymorphism, Multiple Inheritance and Abstract Classes

Assignments Assignment 6
Assessments Quiz 6

Final Project:
Initial Proposal: 1-2 double-spaced pages, due Thursday, March 21 5pm ET
Final Term Paper: At least 8 double-spaced pages, due Thursday, April 25 5pm ET
Final Term Project Presentation: 5-minute presentation, due Thursday, May 2 6pm ET

Course Survival Guide

- Attend every class in person and arrive on time; Be attentive and ask questions; Keep your phone off and away; Study the course materials posted on Blackboard BEFORE coming to class and review them AFTER; Manage and plan for your Homework Assignment deadlines, for no late work will be accepted.
- Be proactive on Blackboard **Class Discussion** Board, asking questions on the Board during and after the class time (some of them will be answered during the class time, and others will be answered outside of class or during the weekly recitation hour), utilizing Blackboard **Water Cooler** Board to form study groups to discuss concepts (but complete all the assignments and assessments independently).
- Attend your weekly recitation hour, use the opportunity to ask questions, go over complicated topics and review for quizzes.
- Consider learning Python programming as like learning a foreign language, which requires: Time commitment (**at least 6 hours per week** outside of class) and practice regularly (**at least 15 minutes per day** will make a big difference within the short time period of a semester).
- Keep yourself as healthy as possible to foster your best learning.

Calendar

Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Jan 2023	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	1	2	3	4
Feb 2023	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	1	2	3	4
Mar 2023	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29	30	31	1
Apr 2023	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	1	2	3	4	5	6
May 2023	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30	31	1	2	3
Jun 2023	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24

Legend:

Class Day | Weekly Short Quiz Due at 6pm

Homework Assignment Due at 5pm

Module Quiz Due at 6pm

Weekly Recitation Zoom Hour

Term Project Presentation and Final Review

Final Exam

Final Project:

Initial Proposal: 1-2 double-spaced pages, due Thursday, March 21 5pm ET

Final Term Paper: At least 8 double-spaced pages, due Thursday, April 25 5pm ET

Final Term Project Presentation: 5-minute presentation, due Thursday, May 2 6pm ET

Spring Break, Yah!

Academic Conduct Policy

Please visit Metropolitan College's website for the full text of the department's *Academic Conduct Code* (https://www.bu.edu/met/current-students/academic-policies-procedures/).

A Definition of Plagiarism

"The academic counterpart of the bank embezzler and of the manufacturer who mislabels products is the plagiarist: the student or scholar who leads readers to believe that what they are reading is the original work of the writer when it is not. If it could be assumed that the distinction between plagiarism and honest use of sources is perfectly clear in everyone's mind, there would be no need for the explanation that follows; merely the warning with which this definition concludes would be enough. But it is apparent that sometimes people of goodwill draw the suspicion of guilt upon themselves (and, indeed, are guilty) simply because they are not aware of the illegitimacy of certain kinds of "borrowing" and of the procedures for correct identification of materials other than those gained through independent research and reflection."

"The spectrum is a wide one. At one end there is a word-for-word copying of another's writing without enclosing the copied passage in quotation marks and identifying it in a footnote, both of which are necessary. (This includes, of course, the copying of all or any part of another student's paper.) It hardly seems possible that anyone of college age or more could do that without clear intent to deceive. At the other end there is the almost casual slipping in of a particularly apt term which one has come across in reading and which so aptly expresses one's opinion that one is tempted to make it personal property."

"Between these poles there are degrees and degrees, but they may be roughly placed in two groups. Close to outright and blatant deceit-but more the result, perhaps, of laziness than of bad intent-is the patching together of random jottings made in the course of reading, generally without careful identification of their source, and then woven into the text, so that the result is a mosaic of other people's ideas and words, the writer's sole contribution being the cement to hold the pieces together. Indicative of more effort and, for that reason, somewhat closer to honest, though still dishonest, is the paraphrase, and abbreviated (and often skillfully prepared) restatement of someone else's analysis or conclusion, without acknowledgment that another person's text has been the basis for the recapitulation."

The paragraphs above are from H. Martin and R. Ohmann, *The Logic and Rhetoric of Exposition, Revised Edition.* Copyright 1963, Holt, Rinehart and Winston.

Academic Conduct Code

I. Philosophy of Discipline

The objective of Boston University in enforcing academic rules is to promote a community atmosphere in which learning can best take place. Such an atmosphere can be maintained only so long as every student believes that his or her academic competence is being judged fairly and that he or she will not be put at a disadvantage because of someone else's dishonesty. Penalties should be carefully determined so as to be no more and no less than required to maintain the desired atmosphere. In defining violations of this code, the intent is to protect the integrity of the educational process.

II. Academic Misconduct

Academic misconduct is conduct by which a student misrepresents his or her academic accomplishments, or impedes other students' opportunities of being judged fairly for their academic work. Knowingly allowing others to represent your work as their own is as serious an offense as submitting another's work as your own.

III. Violations of this Code

Violations of this code comprise attempts to be dishonest or deceptive in the performance of academic work in or out of the classroom, alterations of academic records, alterations of official data on paper or electronic resumes, or unauthorized collaboration with another student or students. Violations include, but are not limited to:

A. **Cheating on examination**. Any attempt by a student to alter his or her performance on an examination in violation of that examination's stated or commonly understood ground rules.

B. **Plagiarism.** Representing the work of another as one's own. Plagiarism includes but is not limited to the following: copying the answers of another student on an examination, copying or restating the work or ideas of another person or persons in any oral or written work (printed or electronic) without citing the appropriate source, and collaborating with someone else in an academic endeavor without acknowledging his or her contribution. Plagiarism can consist of acts of commission-appropriating the words or ideas of another-or omission failing to acknowledge/document/credit the source or creator of words or ideas (see below for a detailed definition of plagiarism). It also includes colluding with someone else in an academic endeavor without acknowledging his or her contribution, using audio

or video footage that comes from another source (including work done by another student) without permission and acknowledgement of that source.

C. **Misrepresentation or falsification of data** presented for surveys, experiments, reports, etc., which includes but is not limited to: citing authors that do not exist; citing interviews that never took place, or field work that was not completed.

D. **Theft of an examination**. Stealing or otherwise discovering and/or making known to others the contents of an examination that has not yet been administered.

E. **Unauthorized communication during examinations**. Any unauthorized communication may be considered prima facie evidence of cheating.

F. **Knowingly allowing another student to represent your work as his or her own**. This includes providing a copy of your paper or laboratory report to another student without the explicit permission of the instructor(s).

G. **Forgery, alteration, or knowing misuse of graded examinations, quizzes, grade lists, or official records of documents**, including but not limited to transcripts from any institution, letters of recommendation, degree certificates, examinations, quizzes, or other work after submission.

H. **Theft or destruction of examinations or papers** after submission.

I. **Submitting the same work in more than one course** without the consent of instructors.

J. **Altering or destroying another student's work or records**, altering records of any kind, removing materials from libraries or offices without consent, or in any way interfering with the work of others so as to impede their academic performance.

K. **Violation of the rules governing teamwork**. Unless the instructor of a course otherwise specifically provides instructions to the contrary, the following rules apply to teamwork: 1. No team member shall intentionally restrict or inhibit another team member's access to team meetings, team work-in-progress, or other team activities without the express authorization of the instructor. 2. All team members shall be held responsible for the content of all teamwork submitted for evaluation as if each team member had individually submitted the entire work product of their team as their own work.

L. **Failure to sit in a specifically assigned seat during examinations.**

M. **Conduct in a professional field assignment that violates the policies and regulations of the host school or agency.**

N. **Conduct in violation of public law occurring outside the University that directly affects the academic and professional status of the student, after civil authorities have imposed sanctions.**

O. **Attempting improperly to influence the award of any credit, grade, or honor.**

P. **Intentionally making false statements to the Academic Conduct Committee or intentionally presenting false information to the Committee.**

Q. **Failure to comply with the sanctions imposed under the authority of this code.**