IE 555 – Programming for Analytics – Spring 2023

Instructor: Dr. Chase Murray
E-mail: cmurray3@buffalo.edu. Please include "IE 555:" in the subject.
Office: 309 Bell Hall
Office Hours: Wednesdays 3-4pm, or by appointment. Students seeking help should first:

- Post (and answer) questions on the GitHub "issues" tracker (https://github.com/IE-555/spring2023/issues)

Teaching Assistant (TA): Prasangsha Ganguly (prasangs@buffalo.edu).
See UBlearns for contact information, office hours, and office location.

- **Credit Hours**: 3 (Lecture)
- **Course Websites**: UBlearns will be used for all course grades;
GitHub will be used for disseminating course materials (e.g., code)
https://github.com/IE-555/spring2023
- **Class Meetings:** Tues/Thurs, 3:30 – 4:50pm, 107 Talbert Hall.
- **Required Textbook:** none
- **Prerequisites:** Familiarity with operations research and/or production systems models. Prior programming experience is not required.

Course Description: This course focuses on the development of the fundamental programming skills required by today's operations research (OR) professionals. In particular, Python will be the programming language employed by this course. The course will begin with an overview of general Python syntax and usage, and will then focus on the use of Python to solve a variety of classic/common problems encountered in the operations research and production systems domains.

Student Learning Outcomes:
Upon successfully completing this course, the student should have an appreciation for, and fundamental understanding of, the following concepts.

1) **Programming/Python Fundamentals**. Students should understand general concepts regarding the use of the Python programming language, including: How to run Python via the interactive shell or via scripts, data structures (e.g., lists and dictionaries), "for" and "while" loops, conditionals, functions, and file input/output (among other basic concepts). Homework assignments will be provided to assess student understanding of these concepts.
2) **Data Collection and Visualization**. One of the powerful functionalities of programming is the ability to obtain relevant data from online sources and to "see" this data. A variety of Python tools are available to this end. We will use the `matplotlib` package to visualize data (e.g., in scatter plots, histograms, box plots, etc.). Lessons on "scraping" data from the Web will also be provided. A homework assignment will be provided to assess student ability to obtain, manipulate, visualize, and interpret data.
3) **Implementing OR Methodologies**. Students will be expected to implement in Python a variety of algorithms traditionally employed in operations research. Homework assignments will assess student understanding of these implementations.
4) **Ability to Self-learn**. This course can only cover a subset of the interesting and useful aspects

of programming. For some assignments, students will be tasked to identify, modify, and implement source code found online.

Supplementary (Optional) Texts:

- http://pythonlearn.com/book.php#python-for-informatics
- http://www.greenteapress.com/thinkpython/thinkCSpy/
- "Python Data Science Handbook: Essential Tools for Working with Data" by Jake VanderPlas
- "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython 2nd Edition" by Wes McKinney

Course Requirements/Evaluation:
Students will be evaluated based on the following:

- (20%) Homework assignments throughout the semester. There will be approximately 6 homework assignments.
- (30%) Midterm Exam.
- (50%) Course Project.

Final course grades will be determined based on the following scale:

Student's Final Average	≥	94.0 %	A	High Distinction
Student's Final Average	≥	90.0 %	A-	High Distinction
Student's Final Average	≥	87.0 %	B+	Superior
Student's Final Average	≥	83.0 %	B	Superior
Student's Final Average	≥	80.0 %	B-	Superior
Student's Final Average	≥	77.0 %	C+	Average
Student's Final Average	≥	73.0 %	C	Average
Student's Final Average	≥	70.0 %	C-	Average
Student's Final Average	≥	67.0 %	D+	Minimum Passing Grade
Student's Final Average	≥	60.0 %	D	Minimum Passing Grade
Student's Final Average	<	60.0 %	F	Failure

- Do not expect your grade to be "rounded up."
- There are no "extra credit" points or "bonus" assignments.

Midterm Exam: The midterm exam will be closed-book and closed-notes, unless specified otherwise by the instructor. The exact date will be announced at least two weeks prior to the exam.

Exam Makeup Policy: The midterm exam must be taken on the date scheduled. Unless there is a medical emergency, make-up exams will not be given. Proof will be required. Students with a valid excuse must notify the instructor prior to the date/time of the originally scheduled exam.

Make-up exams will take place at 7:00am on a date chosen by the instructor. An exam missed *without* a valid documented medical emergency excuse will result in a grade of zero (0) for that exam.

Homework: Homework assignments are designed to help you better understand the course material, and are aimed at helping you to understand the concepts required to complete the course project. Although you may discuss the assignments with your classmates, all work that you submit **must be**

your own work. The due date and grading policy for each homework assignment will be clearly communicated.

Course Project: Students will have two options for the course project:

1) Students may identify a relevant paper from an archived journal which features an algorithm/heuristic designed to solve a particular problem. This algorithm should be coded in Python and validated against the results published in the paper. A final report describing (a) the problem itself, (b) an overview of the solution procedure, (c) a description of how the test data were generating, (d) a summary of the various functions employed to execute the code, and (e) a "how-to" guide for running the Python code is expected.
2) Students may develop their own programming project. In this option, students must identify a source of online data, which will be dynamically imported via Python. The Python code must utilize these data to either make decision support recommendations or provide a detailed analysis of the data. A YouTube video describing the mechanics of the Python code will be required, in addition to a "how-to" guide for running the code. All source code must be submitted, and the course instructor must be able to execute the code without errors.

In either case, students will be expected to present a project proposal in class. Details on the course project will be discussed in class.

There are four key project deliverables:

1) A project proposal [~15%] – This will be in the form of a 1-page written document, due at the beginning of Week 10 (unless directed otherwise).
2) A project status report [~10%] – Each team will be required to submit a written document outlining the status of the project. This document should clearly list all milestones, and should identify those activities that have been completed, those that are in progress, and those that are in danger of being missed. In the latter case, a plan to address these potential misses should be provided. Each team will present their status reports orally in class.
3) Project documentation [~50%] – By the last week of class, each team must submit detailed documentation of the project. This should include instructions for running the code, example outputs, and citations to reference materials. The documentation should also identify potential areas for future improvement. Each team must have their documentation reviewed by at least one other team (and must also review the documentation of at least one other team). Grades will also be based on how well a team evaluates another team.
4) Project demonstration [~25%] – During the last week of class, each team will present their projects in class (or will record a YouTube video of their presentation).

Professionalism: UB SEAS aims to enhance the education of the students in various aspects of professionalism, and to elevate the standards of behavior that are expected from students. The goals are two-fold: (1) to improve the working and learning environment within SEAS, and (2) to best equip students for employment after graduation.

- Students are expected to use professional style in all communications, including email, with course faculty and teaching assistants. This includes the use of salutations and closings (including clear identification of the author) and correct grammar.
- Students are expected to arrive prior to the start of class, and to remain for the duration of the

class.

- Students are expected to refrain from the use of cell phones or other electronic devices unless they are clearly linked to class purposes (e.g., note-taking). Cell phones must remain off or muted.

Grade Disputes: If you disagree with the manner in which an assignment (homework or exam) was graded, you may request a re-evaluation of your assignment within one (1) week of the date that the assignment was returned to you. A re-evaluation request should consist of two (2) components:

- Page 1: A photocopy of your assignment.
- Page 2: A detailed explanation, not exceeding one page in length, describing why you believe your answer was correct.

The instructor will consider each case at the end of the term, but only if it appears that it may change your final grade. Obvious arithmetic errors will be corrected immediately.

Accessibility Resources: If you require classroom or testing accommodations due to a disability, please contact Accessibility Resources (AR), located in 25 Capen Hall. AR can be reached by phone at (716) 645-2608 or by email at stu-accessibility@buffalo.edu. Please inform the instructor as soon as possible about your needs so that he can coordinate your accommodations. Please also visit http://www.buffalo.edu/accessibility.

Academic Honesty and Integrity:

The University at Buffalo has a responsibility to promote academic honesty and integrity and to develop procedures to deal effectively with instances of academic dishonesty. Students are responsible for the honest completion and representation of their work, for appropriate citation of sources, and for respect for others' academic endeavors. By placing their name on academic work, students certify the originality of all work not otherwise identified by appropriate acknowledgments. Please take the time to visit http://academicintegrity.buffalo.edu.

If you fail to meet the UB policy and the instructor's policy for academic honesty and integrity, you will receive an 'F' in the course, and may be subject to suspension or expulsion from the university.

Violations include, but are not limited to:

- **Cheating on an examination, homework assignment, quiz, etc.** – This includes such things as copying from another's paper, using unauthorized notes, calculators, etc., or giving or receiving unauthorized aid, such as trading examinations, whispering answers, passing notes, or using electronic devices to transmit or receive information.
- **Plagiarism** – This is using someone else's work without giving credit. It is, for example, using ideas, phrases, papers, laboratory reports, computer programs, data - copied directly or paraphrased - that you did not arrive at on your own. Sources include published works such as book, movies, web sites, and unpublished works such as other students' papers or material from a research service. In brief, representing someone else's work as your own is academically dishonest. *The risk of plagiarism can be avoided in written work by clearly indicating, either in footnotes or in the paper itself, the source of any major or unique idea or wording that you did not arrive at on your own*. Sources must be given regardless of whether the material is quoted directly or paraphrased.

Copying any part of another student's assignment and putting your name on it is plagiarism.

- **Unauthorized collaboration** – This is working with or receiving help from others on graded assignments without the specific approval of the instructor. *If in doubt, seek permission from the instructor before working with others*. Students are encouraged to learn from one another: Form study groups and discuss assignments, but each assignment must be individual work unless specifically stated and turned in as a group assignment.
- You are encouraged to talk to one another about your assignments, however, all assignments must be done by the student(s) whose name is (are) on it!
- Multiple submission – This means using the same work to fulfill the academic requirements in more than one course. *Prior permission of the instructors is essential*.

Syllabus prepared by C. Murray
Revision History:
1/30/2023 – Unofficial (pre-release) version of syllabus posted on instructor's Website.