Course Outline

ACS-PHYS-2112-050 Scientific Programming with Python

Contents

1 Course Information

This course has two listings: PHYS-2112-050 and ACS-2112-050
2019 Fall Semester

Instructor: Stuart Williams
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Office: 2C31

Office hours (tentative): Wednesday 4:00 p.m. - 5:45 p.m. or by appointment
Class meeting times: Wednesday 6:00 p.m. - 9:00 p.m.
Room: 2L14

Course Outline URL: http://bit.ly/PHYS-2112

Calendar Description:

> PHYS-2112 (3) Scientific Computing with Python (3 hrs Lecture)
>
> This Python language course shows students how to create basic programming structures in Python including decisions, loops and more advanced topics such as object-oriented programming with classes and exceptions. Unique Python data structures such as tuples and dictionaries are introduced. Students learn how to create Python programs with graphic elements as well as data visualization and publication quality figures. Applications from a variety of scientific fields are discussed when appropriate.

2 Topics and Learning Outcomes

Upon the successful completion of this course, the student will have:

- A basic understanding of computer science:
  - Roles of hardware and software in computing
  - Basic design of a modern computer
  - Efficiency of computer algorithms
  - How variables are used in software, and two models of implementing them

- A basic understanding of computer programming:
    - Concept of data types
    - Specific data types: strings, lists, arrays, dictionaries, sets, files
    - How computers represent numbers and characters
    - How to write functions
    - Boolean expressions and if statements
    - Loops
    - Software testing strategies
    - Source code management basics
    - Object oriented programming
    - Fundamental concepts of computer graphics
- The ability to program in Python and some understanding or basic familiarity with the following concepts in Python:

    Objects; names; numbers and operators; sequence functions; string methods; print; string formatting; tuples; lists; sequence indexing and slicing; list comprehensions; sort; dictionaries; sets; blocks; loops; iterables; generator expressions; modules; generators; functions; call by name binding; namespaces; simple classes; classes; instances; subclasses; exceptions; character encoding; standard library modules; standard class methods; function parameters; files; scopes and search order; function locals and non-locals; built-in objects; `import` statement; augmented assignment statements; `class` statement; `type` callable; class internals; bound methods; metaclasses; decorators, special methods of classes; first class objects; the `__call__` method; iterables, iterators, and the iterator protocol; and async.
- Knowledge of the fundamentals of handling large amounts of data in Python efficiently with NumPy and Pandas
- A basic ability to visualize data with matplotlib, and awareness of other visualization options
- Familiarity with techniques to measure and increase the performance of Python code

Note that the details of the objectives above are tentative, so some of them may not be achieved.

3 Course Material

We will use two books:

- Python Programming: An Introduction to Computer Science by John Zelle, available at the University of Winnipeg bookstore, and online.

  Assigned readings from this textbook will average 45 pages per week, or one chapter per week. However, while we recommend you read all of it, you will only be expected to retain, and b etested on, about 70% of the material, or about 30 pages per week.
- The Python Data Science Handbook by Jake VanderPlas (Oâ€™Reilly). Copyright 2016 Jake VanderPlas, 978-1-491-91205-8. https://jakevdp.github.io/PythonDataScienceHandbook/

  This books mostly teaches NumPy and Pandas. Assigned readings from this book will average 45 pages per week (based on the printed book's page count), but most pages have lots of small code samples so the number of words per page will be about half of a typical textbook. This book will be used both as a textbook and a reference. In its role as a textbook it presents concepts you should understand and on which you will be tested. In its role as a reference it will help you complete assignments.

4 Course Schedule

- Week 1 - Sep 4
  - Introduction
  - Required Software
- Week 2 - Sep 11
- Week 3 - Sep 18
- Week 4 - Sep 25
- Week 5 - Oct 2
  - Test 1 (or perhaps Oct 9)
- Week 6 - Oct 9
- Oct 16 - Fall Reading Week Oct 13-19, but 2L14 is open (except October 14th)
- Week 7 - Oct 23
- Week 8 - Oct 30
- Week 9 - Nov 6
  - Test 2
- Week 10 - Nov 13
- Week 11 - Nov 20
- Week 12 - Nov 27
- Dec 18 - Final Exam

5 Grade Distribution

- 30% Assignments (most weeks, approximately 10)
- 20% Test 1
- 20% Test 2
- 30% Final Exam

Important Notes

- Assignments:
  - Assignments will be usually given at the beginning of the class and will be due the following week before class, or other dates as specified by the instructor. Assignments must be submitted online (details will be announced later) as Python code that can be run.
  - Late assignments will not be accepted without prior consent of the instructor.
  - Assignment and solutions will be posted on the course webpage.
  - Some Practice Problems will be posted on the course webpage prior to tests and exams. (tentative)
- Classroom:
  - Attendance of the lectures is expected. Students cannot be admitted to this course if they can't attend regularly due to having another course scheduled simultaneously.
  - Please silence phones during class.
- Assistance: Students are encouraged to consult with me when experiencing difficulties in the course. I will do my best to help and/or provide advice.
- Tests/Exams:
  - No identifications will be asked at the tests/exams.
  - Calculators are not permitted in tests/examinations.

    - Smart phones/cell phones must be switched off for the duration of the tests/exams.
    - Class notes, books, and course materials are not allowed in the test/exams, unless specified by the instructor prior to exam date.

- Communication: Only your University of Winnipeg email address will be used for course related correspondence.

- The voluntary withdrawal date, without academic penalty: November 12, 2019. Please contact me if you are considering dropping the course.

- Grading System: Below are the guidelines for conversion from numerical (percentage) grades to letter grades. The final grades are approved by the Department Review Committee.

  Letter Grade - Percentage:

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  A+   95-100
  A    87-94
  A-   80-86
  B+   74-79
  B    67-73
  C+   61-66
  C    53-60
  D    50-52
  F    0-49
  ```

6 Notes from the Dean

1. When it is necessary to cancel a class due to exceptional circumstances, I will make every effort to inform students via uwinnipeg email (and/or using the preferred form of communication, as designated in this outline), as well as the Departmental Assistant and Chair/Dean so that class cancellation forms can be posted outside classrooms.

2. Students are reminded that they have a responsibility to regularly check their uwinnipeg e-mail addresses to ensure timely receipt of correspondence from the University and/or their course instructors.

3. Please note that withdrawing before the VW date does not necessarily result in a fee refund.

4. The first day of this class is September 4th, 2019. Last class will be held on November 27th, 2019. No make-up classes will be scheduled. See https://www.uwinnipeg.ca/academics/calendar/docs/dates.pdf for all dates.

    - October 13 to 19 - Fall Reading Week - No Classes
        - Monday October 14 - University closed for Thanksgiving Day
    - Monday November 11 - University closed for Remembrance Day

5. Avoiding Academic and Non-academic Misconduct. Students are encouraged to familiarize themselves with the Academic Regulations and Policies found in the University Academic Calendar at: https://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf . Particular attention should be given to subsections 8 (Student Discipline), 9 (Senate Appeals), and 10 (Grade Appeals). Please note, in particular, the subsection of Student Discipline pertaining to plagiarism and other forms of cheating.

   Detailed information can be found at the following:

    - Academic Misconduct Policy and Procedures: https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-policy.pdf and https://www.uwinnipeg.ca/institutional-

analysis/docs/policies/academic-misconduct-procedures.pdf

- Non-Academic Misconduct Policy and Procedures: https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-policy.pdf and https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-procedures.pdf

6. Misuse of Filesharing Sites. Uploading essays and other assignments to essay vendor or trader sites (filesharing sites that are known providers of essays for use by others who submit them to instructors as their own work) involves "aiding and abetting" plagiarism. Students who do this can be charged with Academic Misconduct.
7. Avoiding Copyright Violation. Course materials are owned by the instructor who developed them. Examples of such materials are course outlines, assignment descriptions, lecture notes, test questions, and presentation slides. Students who upload these materials to filesharing sites, or in any other way share these materials with others outside the class without prior permission of the instructor/presenter, are in violation of copyright law and University policy. Students must also seek prior permission of the instructor /presenter before photographing or recording slides, presentations, lectures, and notes on the board.
8. Research Ethics. Students conducting research interviews, focus groups, surveys, or any other method of collecting data from any person, including a family member, must obtain research ethics approval before commencing data collection. Exceptions are research activities done in class as a learning exercise. For submission requirements and deadlines, see http://www.uwinnipeg.ca/research/human-ethics.html.
9. The Dean recommends you watch the University of Winnipeg library video tutorial "Avoiding Plagiarism" https://www.youtube.com/watch?v=UvFdxRU9a8g

7 University of Winnipeg Senate Regulations

1. Students may choose not to attend classes or write examinations on holy days of their religion, but they must notify their instructors at least two weeks in advance. Instructors will then provide opportunity for students to make up work examinations without penalty. A list of religious holidays can be found in the 2019-20 Undergraduate Academic Calendar.
2. Students with documented disabilities, temporary or chronic medical conditions, requiring academic accommodations for tests/exams (e.g., private space) or during lectures/laboratories (e.g., note-takers) are encouraged to contact Accessibility Services (AS) at 204-786-9771 or accessibilityservices@uwinnipeg.ca to discuss appropriate options. All information about a student's disability or medical condition remains confidential http://www.uwinnipeg.ca/accessibility.
3. Reference to the appropriate items in the Regulations & Policies section of the Course Calendar, including Senate appeals and academic misconduct (e.g. plagiarism, cheating) http://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf Instructors should become familiar with the procedures for dealing with alleged academic misconduct at https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-procedures.pdf
4. All students, faculty and staff have the right to participate, learn, and work in an environment that is free of harassment and discrimination. The UW Respectful Working and Learning Environment Policy may be found online at http://www.uwinnipeg.ca/respect/