Western University
Dept. Psychology

PSYC 9040B
Scientific Computing
Winter 2024

Enrollment Restrictions

Enrollment in this course is restricted to graduate students in Psychology, as well as any student that has obtained special permission to enroll in this course from the course instructor as well as the Graduate Chair (or equivalent) from the student's home program.

Instructor and Teaching Assistant Information

Instructor: Paul Gribble
Office: WIRB 4122
Office Phone: 82237
Office Hours: by appointment
Email: pgribble@uwo.ca

Teaching Assistant: Anthony Cruz
Email: acruz27@uwo.ca

Course Website: https://www.gribblelab.org/9040

Course Description

The goal of this one-semester graduate course is to provide you with skills in scientific computing—tools and techniques that you can use in your own research. You will learn to program using a high-level language such as Python and/or MATLAB, both of which have many add-on libraries that provide a rich ecosystem for scientific computing.

Course Format

Face-to-face in person classes

Course Learning Outcomes/Objectives

The course is designed to achieve three goals:

1. You will learn to program in a high-level language (Python and/or MATLAB)
2. You will learn to think computationally and algorithmically about data
3. You will be better prepared to learn more complex scientific computing skills to suit your own research goals

Upon completion of this course, students should be able to:

1. Write programs in a high-level language to analyse data (Python and/or MATLAB)
2. Think about your data computationally and algorithmically
3. Analyse your data using some standard analysis techniques
4. Have the skills to be able to learn more complex analysis techniques to suite your research goals

Course Materials

We will draw from freely available textbooks, resources, and tutorials on the web.

Methods of Evaluation

Grades will be based on weekly programming assignments in which you will apply the knowledge we cover that week to write code that analyses sample data in specific ways. There will likely be 10 assignments, each worth 10% of the final grade. Assignments will be due each Friday afternoon.

Course Schedule

In the first part of the course you will learn some fundamentals of coding in a high-level programming language, including:

- digital representation of data
- basic data types, operators, & expressions
- control flow & conditionals
- functions
- complex data types
- file input & output
- graphical displays of data

In the second part of the course we will learn about a set of topics that we agree upon as a class is of interest to us. We will decide on these in the first week or two of the course. These may include:

- sampling, signal processing, & filtering data
- logic of frequentist statistics
- a few common statistical tests
- fitting models to data
- optimization & gradient descent
- simulating dynamical systems
- some basics of machine learning and/or neural networks
- intro to writing scientific documents using LaTeX, Quarto, pandoc/markdown, etc.
- principles of code organization, version control, and workflow for reproducible research

Week	Date	Topic
1	Jan 15,16	Programming basics I
2	Jan 22,23	Programming basics II
3	Jan 29,30	Programming basics III
4	Feb 5,6	tba
5	Feb 12,13	tba
-	Feb 19,20	*Reading Week*
6	Feb 26,27	tba
7	Mar 4,5	tba
8	Mar 11,12	tba
9	Mar 18,19	tba
10	Mar 25,26	tba
11	Apr 1,2	tba

Statement on Academic Offences
Scholastic offences are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Health/Wellness Services
Students who are in emotional/mental distress should refer to Mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

Accessible Education Western (AEW)

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program.

Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are strongly encouraged to register with Accessible Education Western (AEW), a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AEW and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.