

# Psychology 9040a: Scientific Computing with MATLAB

Paul Gribble  
Fall, 2019

## 1 Course Information

Psychology 9040a: Scientific Computing with MATLAB, Fall 2019

## 2 Instructor Information

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## 3 Course Description

### Goals

The goal of this one-semester graduate seminar 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 in a high-level programming language and scientific computing environment such as MATLAB, Python or R.

The course is designed to achieve three primary goals:

1. You will learn to program in a high-level language
2. You will learn to think computationally and algorithmically
3. You will learn some common computational techniques for data processing and analysis

### Class Times and Location

We will meet twice a week

- Mondays from 1:30 pm to 3:00 pm
- Thursdays from 1:30 pm to 3:00 pm

### Topics

In the first part of the course, which will likely occupy a large part of the semester, you will learn how to write computer programs to solve problems and analyze data. We will make use of several online problem sets such as **Project Euler** (<https://projecteuler.net>) and **Advent of Code** (<https://adventofcode.com>).

Here is a sketch of some of the topics we will likely cover in the course:

## Fundamental Topics

1. What is a computer program?
2. Digital representation of data
3. Basic data types, operators and expressions
4. Control flow
5. Complex data types
6. Functions
7. Input and output
8. Debugging, profiling & speedy code
9. Parallel programming
10. Graphical displays of data

We will choose one (possibly two) more advanced topics to cover near the end of the course as well. Here are some possibilities. We will decide together which one(s) to include.

## Advanced Topics

- Sampling & filtering
- Optimization & gradient descent
- Integrating ODEs & simulating dynamical systems
- Modelling action potentials
- Machine learning: classification

## Prerequisites

There are no formal prerequisites for the course. As a result I expect students in the class to have varying levels of previous experience with computer programming. If you have never programmed a computer before in any high level language then you will have more to learn than students who have previous experience with programming. Please keep this in mind.

## 4 Methods of Evaluation

- 70% Weekly Programming Challenges
- 15% Midterm Exam (take-home programming challenges)
- 15% Final Exam (take-home programming challenges)

## 5 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](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.