2072U Computational Science I course outline, winter 2019

Instructor
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Office hours: Tuesdays 10:00-11:30.

Time and place
Wednesday and Friday 12:40-14:00 in UA1140. First class on January 9th, last class on April 5th.
Please consult MyCampus for the tutorial schedule.

Prerequisites
MATH1020U, MATH1850U or MATH2050U, CSCI2000U.

Text materials
Hans Petter Langtangen, *A Primer on Scientific Programming with Python* (5th edition), Springer, 2016.
Available in electronic format from SpringerLink and Scholars Portal through the UOIT library (login required).
It is essential that you have a working Linux partition (preferred) or Virtual Machine (back-up option) with Python, iPhython and SciPy installed.

Assessment
Final 50%; midterm 15%; assignments 25%, in-class quizzes 5% and participation in tutorials and online discussions 5%. Late assignments will not be considered. There will be no deferred midterm.

Course description
There are two dominant themes in this course: programming applied to scientific computing and the theory and development of numerical algorithms. Using the scientific problem-solving environment provided by Python, we will develop an understanding of the numerical computations that arise in many scientific problems and of their mathematical analysis. In particular, we will consider for a number of basic algorithms under what conditions they provide answers, how efficiently they do so and how accurate the results are.
The topics include basic numerical linear algebra, interpolation, nonlinear root-finding, quadrature and, if time allows, the solution of initial-value problems for ordinary differential equations.

Course outcomes
Upon completing this course you will be able to implement a number of basic computational algorithms in Python. You will understand how to evaluate the efficiency and accuracy of these algorithms using theoretical arguments as well as visualization, and how to combine them to perform more complex computations. The ability to numerically approximate solutions to mathematical problems and visualize data will be useful in many of your third and fourth year courses.

Tentative schedule

Week	Topic	Python	Chapter
1	Introduction		
1–2	Solving nonlinear equations	Functions, loops, lists, branching	1, 2, 3
3–4	Solving systems of linear and nonlinear equations	arrays, scipy, scipy.linalg	4.7, 5
5	Computational complexity		
6	Revision & Midterm test		
7–8	Interpolation and least squares	matplotlib	5
9–10	Integration and differentiation		App. B
11–12	Advanced problem solving		App. E

Accessibility
Students who require alternative testing and examination arrangements or other academic accommodations must contact the Centre for Students with Disabilities as well as the instructor as early as possible.

Academic integrity
You are welcome to collaborate on the assignments and Slack channels will be available for that purpose. However, each student must hand in her or his own assignment for marking. Group submissions are not acceptable. If you submit Python code as part of an assignment, it can be the same as that of the students you collaborated with. In that case, clearly list your collaborators in the submitted files as a comment. Failure to do so may be considered plagiarism.
Refer to
http://academicintegrity.uoit.ca/
for the UOIT policy in matters of academic integrity.

Final examination
The final examination will take place during the final examination period at the end of the semester. It is your responsibility to check the published Examination Schedule. You must present your valid Student ID Card at the examination venue.
Refer to
www.science.uoit.ca/undergraduate/current-students/academic-policies.php
for procedures for requesting deferred examination on the basis of religious, medical or compassionate grounds.

Course evaluation
You will be invited through the MyCampus or Blackboard web site to evaluate this course. Your opinion is important to the instructor and to UOIT, please take ten minutes to formulate your opinion.