

MATH 6020 — Scientific Computing

Fall 2020

Department of Mathematics and Statistics, University of Guelph

Instructor: Prof. A. Willms, MACN 512, ext. 52736

Office Hours: via Email. Also, based on input from the students in the class, I may set up a regular chat session on CourseLink.

Lectures: MW 13:30-14:50 in ROZH 102

Web Site: University's CourseLink system, <http://www.courselink.uoguelph.ca/>.

Course Delivery and COVID 19

This course will be offered in a face-to-face manner, provided the university, local health authorities, or Ontario government do not specify otherwise. The room in which we will meet has 120 seats and so will easily accommodate the class at appropriate physical distancing. The class typically has 10-20 students. For those students who cannot or choose not to come to campus, I will be recording my lectures and posting them on the CourseLink site.

Calendar Description

This course covers the fundamentals of algorithms and computer programming. This may include computer arithmetic, complexity, error analysis, linear and nonlinear equations, least squares, interpolation, numerical differentiation and integration, optimization, random number generators, Monte Carlo simulation; case studies will be undertaken using modern software.

Objectives

This course typically has students from a broad range of backgrounds. The objective is to teach students basic programming skills in C and introduce them to a number of different numerical algorithms for the solution of scientific programming problems.

Topics

C programming including functions, parameter passing, pointers, and structures. We will cover computer arithmetic and error analysis. The linear algebra topics will include QR factorization, least squares minimization, eigenvalues, the singular value decomposition, and iterative methods to solve linear systems.

Resources

Most of the material in the course will come from the text

- *Numerical Linear Algebra*, L.N. Trefethen and D. Bau III, SIAM, Philadelphia, 1997.

If the library opens in a physical manner, then this text will be on reserve. If you want your own copy of this excellent text, it is available from SIAM's web site for US\$72. If you are a member of SIAM (students can get memberships for US\$25, or can get a free membership if their advisor is a SIAM member) the price is US\$50.40. I **strongly** encourage students to have access to this book, especially if you choose not to physically attend lectures.

Other texts that are useful references include:

- *Numerical Analysis*, (any edition, current one is 10th), R. Burden and D. Faires, Thompson Brooks/Cole, 2015.

- *Numerical Analysis*, 2nd edition, T. Sauer, Pearson, 2012.
- *Iterative Methods for Sparse Linear Systems*, 2nd edition, Y. Saad, SIAM 2003.
- *Accuracy and Stability of Numerical Algorithms*, 2nd edition, N. Higham, SIAM, Philadelphia, 2002.

In addition, the primary reference for the C programming language is also on reserve:

- *The C programming language* 2nd edition, B.W. Kernighan, D.M. Ritchie, Prentice Hall, Englewood Cliffs, N.J., 1988.

Evaluation

Note that Friday, Dec. 4 is a "Monday" schedule to compensate for Thanksgiving. Thus there will be a class on Friday, Dec. 4.

There will be three assignments and a final take home exam. All of these will contain a significant programming component. You will be required to write and submit computer code written in C.

Assessment	date	weight
3 Assignments	(approximate dates) 7 Oct., 2 Nov., 25 Nov., in class.	69%
Take-home Final Exam	Issued 2 Dec., Due 15 Dec., 4:00 p.m.	31%

University Policies

Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website <https://news.uoguelph.ca/2019-novel-coronavirus-information/> and circulated by email.

Recording of Lecture Materials

By enrolling in a course, unless explicitly stated and brought forward to their instructor, it is assumed that students agree to the possibility of being recorded during lecture, seminar or other "live" course activities, whether delivery is in-class or online/remote. If a student prefers not to be distinguishable during a recording, they may:

1. turn off their camera
2. mute their microphone
3. edit their name (e.g., initials only) upon entry to each session
4. use the chat function to pose questions

Students who express to their instructor that they, or a reference to their name or person, do not wish to be recorded may discuss possible alternatives or accommodations with their instructor.

Presentations which are made in relation to course work, including lectures, cannot be recorded in any electronic media without the permission of the presenter, whether the instructor, a student, or guest lecturer. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the presenter.

Recorded lectures posted on CourseLink are solely for students to use during the current semester. These recordings may not be reproduced or distributed to others in any form.

Medical Notes

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

E-mail Communication

All students are required to check their University of Guelph e-mail account regularly; e-mail is the official route of communication between the University and its students.

Academic Accommodation of Religious Obligations

If you are unable to complete a course requirement due to religious obligations, please let the instructor know within the first two weeks of class. See the academic calendar for more information: http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2216.shtml

Academic Consideration

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2180.shtml

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor. The Academic Misconduct Policy is detailed in the Graduate Calendar: http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2630.shtml

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. For more information, see: http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2343.shtml

Drop date

Students will have until the last day of classes to drop courses without academic penalty. See the Graduate Calendar information at <https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>