

CS 371/ AMATH 242 – Winter 2020: Course Outline

Introduction to Scientific Computation

Instructor: Leili Rafiee Sevyeri (lrafiees@uwaterloo.ca) DC2302E Office Hours: TBA

Lectures: MW 1:00-2:20 pm STC 0060

TAs: Vedat Levi Alev, vlalev@uwaterloo.ca,
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TA office hours/location will vary; refer to course website on Piazza.

AMATH 242/CS 371: Introduction to Computational Mathematics Web Site (Piazza): <https://piazza.com/uwaterloo.ca/winter2020/amath242cs371>

Course Description

A rigorous introduction to the field of computational mathematics. The focus is on the interplay between continuous models and their solution via discrete processes. Topics include: pitfalls in computation, root finding, solution of linear systems, interpolation, discrete Fourier transforms and numerical integration. Applications are used as motivation.

- **Course Objectives** This course is intended as an introduction to the computational methods and issues encountered when solving realistic examples in scientific computation.

- **Sources of Information**

The main source of information for the course is the material covered in the class lectures. Details of some of the more mathematical material is available in the form of typeset course notes, which are on sale in the W Store (bookstore) in South Campus Hall. However, the notes will not necessarily reflect all of the material presented in the lectures. It is therefore imperative that you attend the lectures and take notes.

- **Intended Audience.** AMATH 242/CS 371 is intended for students interested in the computational aspects that one would encounter in solving various mathematical and scientific problems. Students are expected to be interested in both mathematics and computer science.

- **Related Courses**

- Prerequisites: CS 116/136/146, Math 235/245, Math 237/247, Not open to General Mathematics students.
- Antirequisites: CS 335/370
- Successor: CS 473/475/476/488, AMATH 342/442

- **References**

- Primary Reference: Course notes by Hans De Sterck (available in the W Store (bookstore) in South Campus Hall)

- Additional references that may prove useful:
 - ▷ Numerical Analysis, R.L. Burden and J.D. Faires (any addition)
 - ▷ Numerical Methods: Algorithms and Applications, L. Fausett, Prentice Hall, 2003
 - ▷ Introduction to Scientific Computing, Van Loan, Prentice Hall, 2000
 - ▷ Numerical Computing with MATLAB, C. Moler, SIAM, 2004
 - ▷ Numerical Analysis, T. Sauer, Addison Wesley, 2005

These materials may be used as additional references, but they do not replace the materials delivered in class, which will provide the basis for course exams.

Table : **Tentative Schedule**

Week	Topic (order and timing tentative)	
Week of JAN.6(I)	Floating Point(Chapter 1)	
Week of JAN.13(II)	Floating Point, Root Finding(Chapter 2)	MATLAB Tutorial: TBA
Week of JAN.20(III)	Root Finding	
Week of JAN.27(IV)	Numerical Linear Algebra(Chapter 3)	Assignment 1 due JAN 29(11:59 pm)
Week of FEB.3(V)	Numerical Linear Algebra	
Week of FEB.10(VI)	Interpolation (Chapter 5)	Assignment 2 due FEB 12(11:59 pm)
Week of FEB.17(VII)	Winter break	
Week of FEB.24(VIII)	Interpolation	Midterm: FEB 26, 7:00:00-8:30 pm, MC 1085
Week of MR.2(IX)	Integration (Chapter 6)	
Week of MR.9(X)	Integration	
Week of MR.16(XI)	Discrete Fourier Methods (Chapter 4)	Assignment 3 due MAR 16(11:59 pm)
Week of MR.23(XII)	Discrete Fourier Methods	
Week of APR.1(XIII)	Course Review (Last lecture on APR 1)	Assignment 4 due APR 3(11:59 pm)

- **Piazza.**

We will make use of Piazza for online class discussion, announcements, assignment posting, and general course management, so please be sure to sign up and keep up with postings. Rather than emailing questions to the instructor or TA, you are encouraged to post your questions on Piazza so that everyone can benefit from the discussion and answers. However, note that you must not post solutions to assignment questions on the forum. Our class Piazza page can be found at:

<https://piazza.com/uwaterloo.ca/winter2020/amath242cs371>

- **Programming Languages.**

MATLAB is to be used for the programming assignments. There are many sources of MATLAB information on the Web. There are also many reference books available. A MATLAB tutorial will be held on **January 14, from 5:30-7:00 pm at MC 1085**. Students are strongly encouraged to attend. An announcement will be posted. The best way to learn MATLAB is to start the assignments early, and see the TAs or instructor if you have problems. You should start the assignments as soon as possible, well before the due date, to get familiar with MATLAB.

- **Assignments.**

Assignments will be posted on the Piazza page and Crowdmark for the course approximately 15 days

before the due dates. Check to make sure you are using the most recent version (corrections will be made to the posted assignment if necessary).

Put your name, student ID, and time of your lecture section on the first page. Please retain a copy of your assignment after submission.

There will be four assignments. All assignments must be submitted via Crowdmark before the due date. Students are welcome to discuss the assignment solutions with the instructor and TAs after the assignments are graded.

Assignment/midterm solutions will be discussed in class. Solutions will not be posted online. Assignment/midterm marks will be posted on LEARN (or equivalent). Notify the instructor immediately if you believe the mark was recorded incorrectly. The marks recorded on LEARN are considered final two weeks after the assignments or midterm are returned.

- **Late Policy.**

Late assignments will be accepted up to 24 hours late. There will be a penalty for late submission. It won't be accepted by Crowdmark and you will get zero. If you submit an assignment late, email the instructor so that course staff know the assignment was submitted late. Late assignments submitted any time in the 24 hours immediately following the deadline will be marked, and receive half (i.e. 50 percent) credit for correct answers. Assignments submitted after 24 hours will not be marked and receive zero.

- **Questions about the current assignment.**

TAs and/or instructors will monitor the Piazza forums, and hold office hours throughout the term. As this is a third year CS course the TAs will, for the most part, **not** help students debug programs. Students are expected to be able to do this themselves at this stage.

- **Marking.**

The assignments will consist of programming and analytic work. Most of the marks for the programming problems will be given for the description of the algorithm and explanation of the results or outputs. Simply submitting "raw code" will get very few marks. Assignment figures and graphs should be carefully thought out to present the data and conclusions in an effective and clear manner. Poor presentation of your work will result in a poor mark. In all cases, we expect you to explain your algorithm, and describe what you see in detail. You should also submit your code, along with documentation. MATLAB has good plotting functions. Create figures with MATLAB to include in your assignments.

- **Midterm Date and Location.**

The midterm is scheduled for **Wednesday, February 26, 2020, from 7:00-9:00 pm, UW M3 1006**. Please inform the instructor as soon as possible if you have a legitimate conflict with this time. You will be expected to provide documentation to support the conflict. **The instructor must be made aware of any conflicts at least two weeks prior to the exam for accommodations to be considered.** If you believe you received an unfair mark on the midterm, you will have up to two weeks after the marks are released to request a re-mark. Please provide a written explanation (email is acceptable) explaining any concerns you have about the marking.

- **Grade Calculation.**

- Assignments 32% (all assignments are equally weighted)
- Midterm 28%

- Final 40%

Students must receive a passing grade on the weighted average of the midterm and final exams (i.e. must obtain at least 34 / 68 marks on the exams) in order to pass the course. Otherwise, the exam average will be the assigned grade. Course grades will be available on UW LEARN throughout the term.

- **Collaboration.**

You are encouraged to discuss assignments with other individuals in the class. However, the submitted assignment should be your own work. Note that current Math faculty policy is that a mark of -100% can be recorded for the assignment in question in the case of cheating/copying.

- **Missed Materials.**

- If a student is unable to write the midterm exam for legitimate reasons, it is the student's responsibility to provide originals of supporting documentation to the instructor as soon as possible. If accepted, the final exam will be weighted as 68% of the final grade.
- If a student is unable to complete an assignment on time for legitimate reasons, it is the student's responsibility to provide supporting documentation to the instructor as soon as possible. If accepted, the weight of the assignment will typically be shifted to the other assignments. If more than one assignment is affected, alternate steps will be considered.
- As supporting documentation for a missed assignment or exam, provide a university Verification of Illness form, a letter from a counselor, or other suitable formal document, depending on the circumstances.
- If an assignment or midterm is missed without acceptable explanation, a grade of 0 is assigned.

- **Additional Student Responsibilities.**

- It is the student's responsibility to be aware of assignment deadlines and the midterm date.
- It is the student's responsibility to check for appropriate course drop deadlines (<http://quest.uwaterloo.ca/undergraduate/dates.html>) and final exam dates (<http://www.registrar.uwaterloo.ca/exams/finalexams.html>).
- Students are advised not to make any travel arrangements before the final examination times are posted. Under no circumstances will alternate examinations be scheduled for students who have made travel arrangements which conflict with the final examination. Students must inform the Registrar's Office, by the date posted on the Registrar's website, if they have a conflict in the final examination schedule. Note that there is a precise definition of conflict provided by the Registrar's Office available at:
<http://www.registrar.uwaterloo.ca/exams/finalexams.html>
The course instructor will then be contacted by the Registrar's Office to make alternate arrangements. Under no circumstances will the instructor make alternate arrangements for a final examination unless given instructions by the Registrar's Office.

- **Important University-wide Information**

- **Plagiarism.**

Plagiarism is representing the work of others as your own. Plagiarism on exams includes using unauthorized aids or communicating in any way with others during an examination. Plagiarism on assignments includes copying another student's solution and submitting it as your own, allowing another student to copy your solution, collaborating excessively with another student, or obtaining solutions from any other source. See the section on Discipline below for typical penalties. All academic offenses are

reported to the Associate Dean for Undergraduate Studies and are recorded in the student's file. Subsequent academic offenses in the same course or in other courses will lead to more severe penalties, up to and including suspension and expulsion. We encourage you to discuss general concepts and problems with classmates, tutors, TAs, and instructors. However, the solution that you submit must be worked through by yourself and written in your own words. It is not acceptable to work on an assignment with somebody else and write it up individually.

- **Academic Integrity.**

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. Check the Office of Academic Integrity's website, www.uwaterloo.ca/academicintegrity for more information.

- **Grievance.**

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, <http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm> When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

- **Discipline.**

A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about rules for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline, <http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm> . For typical penalties check Guidelines for the Assessment of Penalties, <http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm>

- **Avoiding Academic Offenses.**

Some students are unaware of the line between acceptable and unacceptable academic behavior, especially when discussing assignments with classmates and using the work of other students. For information on commonly misunderstood academic offenses and how to avoid them, students should refer to the Faculty of Mathematics Cheating and Student Academic Discipline Policy, http://www.math.uwaterloo.ca/navigation/Current/cheating_policy.shtml

- **Appeals.**

A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals, <http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>

- **Note for students with disabilities.**

The Access Ability Services Office (AAS), located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to

lessen the impact of your disability, please register with the AS at the beginning of each academic term. <http://uwaterloo.ca/disability-services/>