## Course Description

This course is an introduction to the use of computers to compute solutions of mathematical problems. Topics include finding zeros of functions, polynomial interpolation, numerical integration, solution of linear systems, and Monte Carlo methods. For most of the problems we consider, a computer can only provide an approximation to a solution, and we will be interested in being able to quantify precisely the error in our approximate solution, as well as the amount of effort needed to reduce the error of our approximations. In addition to considering these theoretical issues, students will also produce working computer codes. No prior programming experience is needed, and the fundamentals of programming in Matlab/Octave will be taught as part of the course.

## Essential Information

| | |
|---|---|
| Professor: | David Maxwell |
| Office: | Chapman 308C |
| Phone: | 474-1196 |
| Email: | `damaxwell@ualaska.edu` |
| Web: | `http://www.math.uaf.edu/~maxwell` |
| Prerequisites | MATH F302 (Differential Equations) or MATH F314 (Linear Algebra) or my permission |

## Course Text

The required text is: **Numerical Methods**, Anne Greenbaum and Timothy Chartier, Princeton University Press The course web page will list other supplementary resources.

## Class Time

There will be three hours of class lecture each week.

Lecture Times
MWF      11:45–12:45 Zoom

## Covid 19

We are holding classes in unprecedented times.

- We need to be especially kind and patient with one another.

- Unforseen circumstances are going to occur. I will try to ensure that the class is taught in a way so that if you must miss a class due to illness or other reasons, you will have tools to make up the missed class. Please see the section below on Zoom and recordings.

- If circumstances routinely impact your ability to participate in the course, please get in touch with me so we can determine a best plan of action.

- Course practices or this syllabus may need to be adjusted as the semester progresses. I will announce any changes as needed; syllabus updates will be posted on the web site.

- Univesity policies related to COVID-19 are found at https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students. These can be expected to be updated.

## Zoom Meetings
We will meet remotely via Zoom. A link to the meetings is provided in BlackBoard and on Piazza. We are all learning the norms for holding classes this way, and we will figure out as the semester progresses how make this efficient and effective.

Classes will be recorded so that you can review from them later if your internet connection is poor or if you are unable to attend a class.

## Office Hours
My office hours will be posted on my web site and outside my office door. These will be held via Zoom at a link made available on Piazza. You are welcome to schedule an appointment outside of my regular office hours; please send me an email and we will arrange a time.

## Piazza
We will use the Piazza social media site for announcements and after-class questions and discussions. See the course web page for instructions on how to sign up.

## Homework
There will be a homework assignment due roughly every week, usually on Mondays. Each week's assignment will be posted on my web page. You will submit your homework via a Dropbox File Request link found on the course web site. Uploaded files should be a PDF file that contains both your name and the assignement number in the filename. E.g., `DavidMaxwell-HW1.pdf`.

Homework must be in the form of a single PDF file. Solutions will often comprise computer code along with output as well as a written component. You will want to present your work coherently. You are enouraged to use some form of software to author your solutions. LaTeX is mathematical typesetting software that you might find useful; I have posted installation instructions, a guide, and a sample solution so you can see how to use it. Another possibility is Microsoft Word, though mathematics in it is cumbersome. I will accept handwritten solutions so long as your homework arrives as a single PDF, is legible, and it easy to navigate with all components of a solution (code, output, written) appearing together.

Regarding late homework, I will accept from each student a single late homework with no questions asked. To take advantage of this opportunity, simply hand in a note (in the usual Dropbox File Request) in lieu of your homework notifying me that you are using your free late assignment. Your late homework will be due when the subsequent homework is due, or one week later, whichever comes first. Exceptions: you may not use your freebie for either of the first two, or the last homework assignments.

Subsequent late homeworks will be accepted only under extenuating circumstances to be determined at my discretion. We are living in unusual times, and this will be taken into account.

Making an attempt at the homework is mandatory. If you fail to substantially complete two homework sets you will need to come talk with me about potential extenuating circumstances. I reserve the right to drop students who are not completing homework.

## Midterms
There will be one midterm exam as listed in the schedule.

## Final Exam
There will be a comprehensive final exam on the day listed in the schedule.

## Matlab/Octave

There's no point in learning numerical analysis unless you actually get a computer to solve problems for you. So you will write computer code routinely during the course of the semester. I don't expect you to have much or any experience doing this; you will learn how as the semester progresses. But you are expected to want to do this! As a key first step, you will want to install either a copy of Matlab, or a copy of Octave on a computer accessible to you. Additionally, Matlab is available on the Chapman Math Lab computers, as well as on certain engineering computers. The student edition of Matlab costs $49 and can be purchased online. There are instructions on the course web page for installing Octave.

## Evaluation
Course grades will be determined as follows:

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|---|---|
| Homework | 40% |
| Midterm | 30% |
| Final | 30 % |

Letter grades will be assigned according to the following cutoff scores. This scale is a guarantee; I also reserve the right to lower the thresholds.

| | | | | | |
|---|---|---|---|---|---|
| A+ | 97% | C+ | 77% | F | $\leq 59$ |
| A | 93% | C | 73% | | |
| A- | 90% | C- | 70% | | |
| B+ | 87% | D+ | 67% | | |
| B | 83% | D | 63% | | |
| B- | 80% | D- | 60% | | |

## Tentative Schedule
The following is a tentative list of the topics to be covered in this class. As we proceed in the course, the course web page will list specific sections to be read for each week.

| Week | Topics and Events |
|---|---|
| 8/24 – 8/28 | Introduction to Matlab |
| 8/31 – 9/4 | Finding roots of functions |
| 9/7 – 9/11 | Finding roots of functions, continued<br>Monday: Labor Day |
| 9/14 – 9/18 | Computer arithmetic |
| 9/21 – 9/25 | Solving linear systems |
| 9/28 – 10/2 | Solving linear systems, continued |
| 10/5 – 10/9 | Solving linear systems, continued |
| 10/12 – 10/16 | Polynomial interpolation |
| 10/19 – 10/23 | Polynomial interpolation, continued<br>Friday: Midterm |
| 10/26 – 10/30 | Numerical integration |
| 11/2 – 11/6 | Numerical integration, continued |
| 11/9 – 11/13 | Solution of ODEs |
| 11/16 – 11/20 | Solution of ODEs, continued |
| 11/23 – 11/27 | Monte Carlo methods<br>Thursday: Thanksgiving |
| 11/30 – 12/4 | Catch up, review<br>Friday: Last day of class |
| 12/7 – 12/11 | Finals week<br>Monday: Final exam at 11:15am |

# Rules and Policies

### Collaboration
 You are encouraged to work together in solving homework problems. But each student must write up his or her own solutions independently. If you receive significant help solving a problem, it is customary to make a note in your homework to give the person who helped you credit.

### Makeup Exams
 You can make up an exam if certain extenuating circumstances prevent you from taking it and if you inform me in advance. Contact me as soon as possible if you are going to miss an exam.

### Attendance
 Attendance is not included directly as part of your grade. Despite this fact, it is in your best interest to attend every class.

### Cell Phones
 Turn off your cell phone before you come to class.

### Disabilities Services
 I will work with the Office of Disabilities Services (203 Whitaker, 474-7043) to provide reasonable accommodation to students with disabilities.

### Incomplete Grade
 Incomplete (I) will only be given in Computer Science, Mathematics or Statistics courses in cases where the student has completed the majority (normally all but the last three weeks) of a course with a grade of C or better, but for personal reasons beyond his/her control has been unable to complete the course during the regular term. Negligence or indifference are not acceptable reasons for the granting of an incomplete grade. (Note: this is essentially the old University policy.)

### Late Withdrawals
 A withdrawal after the university deadline from a Department of Mathematical Sciences course will normally be granted only in cases where the student is performing satisfactorily (i.e., C or better) in a course, but has exceptional reasons, beyond his/her control, for being unable to complete the course. These exceptional reasons should be detailed in writing to the instructor, department head and dean.

### Academic Dishonesty
 Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.