Instructor: Aaron Barrett, LCB 315, barrett@math.utah.edu, pronouns: he/him/his

Office Hours: Tuesday 1:00-2:00 and Friday 3:00-4:00 or by appointment. I am available to meet both virtually or in-person.

Textbook: There is no required textbook. Students will need a computer with the MATLAB programming environment. Mathematica is also suggested. MATLAB and Mathematica are available to students at the student store. Suggested texts include:

- *Numerical Analysis* by Burden and Faires,
- *Numerical Mathematics and Computing* by Cheney and Kincaid,
- *Theoretical Numerical Analysis: A Functional Analysis Framework* by Atkinson,

Prerequisites: “C” or better in vector calculus and linear algebra.

Course Description: Numerical linear algebra, interpolation, integration, differentiation, approximation (including discrete and continuous least squares, Fourier analysis, and wavelets), initial- and boundary-value problems of ordinary and partial differential equations. Programming experience is necessary prior to taking this course.

Course Objectives: Students will gain an understanding of the various numerical techniques used to approximate common math models. While we will touch on the theory behind the methods, because of the massive scope of the class and minimal time available, the primary exploration will be implementation based. There are two primary goals for this class. First, students will learn to, given a specific problem, identify the most useful method for that problem. Second, students will build a tool set that can then be applied to future problems.

Student Feedback: Student feedback is essential to this class. I have limited ability to assess your understanding before I grade assignments. Therefore, it is to your advantage to ask questions and inform me if something needs to change.

Course Resources: All lecture notes will be posted before class so that students may preview the day’s topics and prepare accordingly. There are no textbooks required, but students may find the MATLAB documentation located at [https://www.mathworks.com/help/matlab](https://www.mathworks.com/help/matlab) to be helpful. All codes we write in class will be uploaded promptly (after I fix bugs).

The material this semester will be approached from an alternative perspective than is traditional. Topics will be presented from a linear algebra perspective. As such, many online and textbook resources may approach the topics in a different fashion. This is *not bad or wrong*, just a warning.
I sincerely believe that the linear algebra approach is simpler to understand and unifies the various topics we will cover.

**Course Policies:** This course will be held in person. Except in cases of ADA accommodations or quarantining due to COVID-19 exposure or infection, you will be expected to attend class in person and complete assignments and exams in person. If I notice a repeated pattern of missed attendance without notice, I reserve the right to limit resubmission of assignments (described below).

If something arises that will force you to miss class or if you need additional support, please reach out as soon as possible so we may find a work-around.

**COVID-19 policies:** University leadership has urged all faculty, students, and staff to model the vaccination, testing, and masking behaviors we want to see in our campus community. These include:

- Vaccination,
- Masking indoors,
- If unvaccinated, getting weekly asymptomatic coronavirus testing.

**Homework:** Homework will be given every other week. Assignments will be given on Monday and will be due on Friday before the end of the day. Students may work together on the homeworks, but must acknowledge those that they worked with. If you are unhappy with your homework grade, you may submit corrections within three days of the homework being returned for half credit.

**Programming Problems:** Additionally, programming problems will be given weekly and due the following week. These may be completed in groups of up to three. Programs may be written in any easy-to-access language, and are expected to be clear, clean, and well commented. A grading rubric for the programming problems will be circulated in the first week of the semester. Programming problems may be resubmitted for full credit within three days of the homework being returned.

**Exams:** We will have three exams over the course of the semester approximately equally spaced over the semester. The final exam will be cumulative. If you are unhappy with your score on the first two exams, you may retest the portions that you missed for half credit. The retest will consist of similar problems to those on the original test. The precondition for retesting is meeting with me to go over your previous exam.

**Grades:** Your grade will be determined according to the following:

- 20% Homework
- 20% Programming
- 20% Exam 1
- 20% Exam 2
- 20% Final Exam
The final grade will be determined according to the following scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>≥ 92</td>
</tr>
<tr>
<td>A-</td>
<td>≥ 88</td>
</tr>
<tr>
<td>B+</td>
<td>≥ 84</td>
</tr>
<tr>
<td>B</td>
<td>≥ 80</td>
</tr>
<tr>
<td>B-</td>
<td>≥ 76</td>
</tr>
<tr>
<td>C+</td>
<td>≥ 72</td>
</tr>
<tr>
<td>C</td>
<td>≥ 68</td>
</tr>
<tr>
<td>C-</td>
<td>≥ 64</td>
</tr>
<tr>
<td>D+</td>
<td>≥ 60</td>
</tr>
<tr>
<td>D</td>
<td>≥ 56</td>
</tr>
<tr>
<td>D-</td>
<td>≥ 52</td>
</tr>
</tbody>
</table>

Course Outline:

- Finite Precision and Linear Algebra Review .................. ~ 1 week
- Interpolation ................................................. ~ 2 weeks
- Root Finding .................................................. ~ 2 weeks
- Finite Differences ............................................. ~ 1.5 weeks
- Quadrature ..................................................... ~ 1.5 weeks
- Initial Value Problems ......................................... ~ 2 weeks
- Boundary Value Problems ........................................ ~ 1 week
- Linear Systems .................................................. ~ 2 weeks

Important Dates:

- First day of Classes ........................................... Monday, January 10
- Last day to add without a permission code .......... Friday, January 14
- Last day to add, drop, audit .................................. Friday, January 21
- MLK Day holiday ................................................ Monday, January 17
- Presidents’ Day .................................................... Monday, February 21
- Spring Break .................................................... March 6-13
- Last day to withdraw from classes ......................... Friday, April 1
- Last Day of Classes .............................................. Tuesday, April 26
- Final Exam ....................................................... Thursday, April 28, 2021 10:30 - 12:30 pm

Academic Honesty: Students are expected to turn in their own independent work. Students are encouraged to discuss the homework and material with other students, but must turn in their own work. If you work together on a problem, please acknowledge who you worked with on the write-up. Students may use online resources. Students are expected to uphold the Honor Code.

Syllabus Changes: The instructor reserves the right to make changes to the syllabus, including due dates and test dates. These changes will be announced as early as possible.

University of Utah Resources and Policies

ADA Statement: The University of Utah is fully committed to policies of nondiscrimination and equal opportunity. The Americans with Disabilities Act requires that reasonable accommodations be provided for students with physical, cognitive, systemic learning, and psychiatric disabilities, and the University seeks to provide equal access to its programs, services, and activities for people with disabilities. Reasonable prior notice is necessary to arrange such accommodations, and students are responsible for obtaining the accommodations and notifying the instructor through official channels early in the semester.
**Addressing Sexual Misconduct:** Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veterans status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, SSB 328, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677.

**Campus Safety:** The University of Utah values the safety of all campus community members. To report suspicious activity, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

**Diversity and Inclusivity Statement:** It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

**Undocumented Student Support Statement:** Immigration is a complex phenomenon with broad impact, those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801-213-3697 or visit [https://dream.utah.edu](https://dream.utah.edu)

**Wellness Statement:** Rates of burnout, anxiety, depression, isolation, and loneliness have noticeably increased during the pandemic. Additionally, personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a students ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at [https://wellness.utah.edu](https://wellness.utah.edu) or 801-581-7776.