Spring 2023

AMATH 352: Applied Linear Algebra and Numerical Analysis

Location: SIG 134 (12:30pm – 1:20pm)

Instructor: Amin Rahman; Office: Lewis 116; Email: arahman2@uw.edu

TA: Rohin Gilman and Keunwoo Lim. Online Office hours: To Be Announced + by appointment

Website: http://faculty.washington.edu/arahman2
Prerequisites: MATH 126 or MATH 136.
Textbook: Applied Linear Algebra by Peter J. Olver and Chehrzad Shakiban (free e-book through UW libraries) https://orbiscascade-washington.primo.exlibrisgroup.com/permalink/01ALLIANCE_UW/db578v/cdi_askewsholts_vlebooks_9783319910413

Course Description: Analysis and application of numerical methods and algorithms to problems in the applied sciences and engineering. Applied linear algebra, including eigenvalue problems. Emphasis on use of conceptual methods in engineering, mathematics, and science. Extensive use of MATLAB for programming and solution techniques.

MATLAB will be used as the primary environment for numerical computation, and will be the only language formally taught and supported in office hours, but if you choose to you may submit solutions in Python. No previous coding experience is required (although it would help); an overview of the appropriate syntax, code structure and algorithms will be given.

Learning Objectives: In this course you will implement methods and tools from linear algebra. You will learn to:

- Understand and apply theorems from linear algebra
- Implement fundamental algorithms from linear algebra

Many students enjoy the dual nature of this course --- both theory (linear algebra) and computation (MATLAB). But with this luxury comes potential complications. It is possible to understand linear algebra but struggle with the MATLAB component of the course, and vice versa. So, it is imperative to make use of all resources that are available (instructor, TA, etc.).

Course Structure: The lectures will be in-person (unless otherwise noted by official communication from the university. All Office/Lab hours will be primarily in-person (but a Zoom option will be provided whenever possible) and conducted by the instructor and TAs. During instructor office hours we will focus on the theory rather than the coding. We do understand that each student's educational preferences are different, and therefore the level

of interaction is completely up to the student – I will never pressure you to participate in discussions if you do not wish to.

Over the past two years, we have faced unprecedented circumstances and challenges. Please remember that your health, safety, and well-being are more important than your performance in this class. I encourage you to reach out to DRS, me, or the TAs if you believe that there exist any additional accommodations that would improve your learning experience this quarter. In cases where the TAs and I are unauthorized to provide assistance, we will help you reach out to DRS. In addition, if you wish to anonymously discuss safety and well-being concerns for yourself or others, you can call SafeCampus at 206-685-7233 anytime, no matter where you work or study. SafeCampus's team of caring professionals will provide individualized support, while discussing short- and long-term solutions and connecting you with additional resources when requested.

Online communication: In addition to in-person lectures, we will mainly use Canvas to communicate. In the past, Piazza was used, however they switched to a pay platform, so we will use the Canvas discussion board instead. I will go through the boards frequently, but TAs and other students are also encouraged to reply to questions. This is also where I will keep track of what concepts to go over during instructor office hours. We will also have a course discord channel where students can help each other and for more informal discussions.

Please note that there are **100 students** (expected) in this course, and therefore emails would not be the most efficient form of communication.

Coding Projects: Five coding projects will be assigned throughout the quarter. These require the implementation of ideas from lecture.

Written Homework: Weekly written homework will be assigned, which will be graded via Canvas.

Additional practice problems will be assigned. It is expected that you complete these problems in addition to those you turn in.

Midterm Exam: An Oxford style (two-day) Midterm will be given half way through the term. The Midterm will test you on the theory only; no coding will be expected. In certain special circumstances a makeup exam may be given after the student follows all university protocol.

Final Exam: An Oxford style (two-day) Final will begin on the last class and finish on the official finals day. The Final will test you on the theory only; no coding will be expected. In certain special circumstances a makeup exam may be given after the student follows all university protocol.

Tentative Schedule:

Week	Topics	Project	Homeworks	Notes
3/27 – 3/31	MATLAB Tutorial, Sec. 1.1, 1.2	CP1 due 4/6	HW1 due 4/10	
4/3 – 4/7	Sec. 1.3	CP2 due 4/17		
4/10 – 4/14	Sec. 1.4, 1.7, 9.4, 1.5		HW2 due 4/20	
4/17 – 4/21	Sec. 1.6, 1.8, 1.9, 2.1	CP3 due 5/1		
4/24 – 4/28	Sec. 2.2 – 2.4		HW3 due 5/1	Short HW
5/1 – 5/5	Midterm review			Midterm 5/3, 5/5
5/8 – 5/12	Sec. 2.5, 3.1, 4.1		HW4 due 5/18	Open Assignment Week
5/15 – 5/19	Sec. 3.2, 4.3, 5.4	CP4 due 5/26		SIAM DS23 Conference
5/22 – 5/26	Sec. 8.2, 8.3, Parallel computing, Machine learning	CP5 due 6/9	HW5 due 6/1	
5/31 – 6/2	Final Exam Review			Memorial Day Monday Final Exam 6/2 and 6/8
6/3 – 6/9	Finals Week			Open Assignment Week

Course Grade: Coding Projects (30%), Homeworks (20%), Midterm (20%), Final Exam (30%)
Tentative Curve: $\geq$ **96%: 3.9 – 4.0**, 90 – 95: 3.5 – 3.8, **87 – 89: 3.2 – 3.4**, 83 – 86: 2.9 – 3.1, 80 – 82: 2.5 – 2.8, **77 – 79: 2.2 – 2.4**, 73 – 76: 1.9 – 2.1, 70 – 72: 1.5 – 1.8, **67 – 69: 1.2 – 1.4**, 63 – 66: 0.9 – 1.1, 60 – 62: 0.7 – 0.8, < 60: 0.0

University policies

1. **UW Student conduct policy: https://www.washington.edu/studentconduct/**
2. **Academic integrity:** https://www.washington.edu/cssc/facultystaff/academic-misconduct/
3. **Observance of religious holy day:** Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Faculty Syllabus Guidelines and Resources. Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form available at: https://registrar.washington.edu/students/religious-accommodations-request/
4. **Disability resources: https://depts.washington.edu/uwdrs/**

5. **Safety:** https://www.washington.edu/safecampus/