MATH 2331-03(19051): Linear Algebra
Spring 2020, TuTh 8:30 am–10:00 am

Instructor Andreas Mang

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🌐 https://www.math.uh.edu/~andreas

Office PGH 614

Online Office Hours By appointment (andreas@math.uh.edu)

Synchronous Class Time TuTh 8:30 am–10:00 am on MS Teams (synchronous)

Course Website https://www.math.uh.edu/~andreas/teaching/math2331-SP20

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In response to the City of Houston and Harris County emergency health declarations, and to mitigate the spread of COVID-19, the University of Houston paused face-to-face instructional activities and will start to deliver all classes remotely using online and/or virtual learning platforms for the duration of the entire semester.

1   Prerequisites

Credit for or concurrent enrollment in MATH 1432.

2   Textbook

Linear Algebra and Its Applications, 5th Edition, by David C. Lay, Steven R. Lay & Judi J. McDonald. ISBN13: 9780321982384.

You will not be required to purchase this textbook. All material discussed in class will be provided. Nonetheless, note that it may be helpful to go over the material in the book after or before it is discussed in class.

3   Course Content

Linear Algebra, rich in applications within mathematics and to many other disciplines, is potentially the most interesting and worthwhile undergraduate mathematics course you will complete. For many of you this is the first course to begin bridging the gap between concrete computations and abstract reasoning. Later in your career, computers will do the calculations, but you will have to choose the calculations, know how to interpret the results, and then explain the results to others. Understanding the notions of vector spaces, linear (in)dependence, dimension, and linear transformations will help you make sense of matrix manipulations at a deeper level, clarifying the underlying structure. A key aim of this course is that you will not only be equipped with a computational ability but with the ability to use these notions in their natural scientific contexts, and with an appreciation of their mathematical beauty and power.

4 Tentative Schedule

Course material will be made available section by section on Blackboard. A detailed, tentative schedule can be found below.

Week	Date	Topic	
1	01/14	Systems of Linear Equations	§1.1
	01/14	Row Reduction and Echelon Forms	§1.2
	01/16	Vector Equations	§1.3
	01/16	The Matrix Equation $\mathbf{Ax} = \mathbf{b}$	§1.4
2	01/21	Solutions Sets of Linear Systems	§1.5
	01/21	Linear Independence	§1.7
	01/23	Introduction to Linear Transformations	§1.8
	01/23	The Matrix of a Linear Transformation	§1.9
3	01/28	Matrix Operations	§2.1
	01/28	The Inverse of a Matrix	§2.2
	02/30	Characterization of Inverse Matrices	§2.3
	02/30	Partitioned Matrices	§2.4
4	02/04	Matrix Factorization	§2.5
	02/06	*Review/Catch up/Special Topics*	
5	02/11	*Review/Catch up/Special Topics*	
	02/13	**Midterm Exam #1**	
	02/13	Subspaces of $\mathbb{R}^n$	§2.8
6	02/18	Introductions to Determinants	§3.1
	02/18	Properties of Determinants	§3.2
	02/20	Vector Spaces and Subspaces	§4.1
	02/20	Null Spaces, Column Spaces, and Linear Transformations	§4.2
7	02/25	The Dimension of a Vector Space	§4.5
	02/25	Rank	§4.6
	02/27	Change of Basis	§4.7
	02/27	Eigenvectors and Eigenvalues	§5.1
8	03/03	The Characteristic Equation	§5.2
	03/03	Digitalization	§5.3
	03/05	Eigenvectors and Linear Transformations	§5.4
	03/05	*Review/Catch up/Special Topics*	
9	03/10	**UH Holiday (no class)**	
	03/12	**UH Holiday (no class)**	
10	03/17	**Midterm Exam #2**	
	03/19	Inner Product, Length, and Orthogonality	§6.1
	03/19	Orthogonal Sets	§6.2
11	03/24	Orthogonal Projections	§6.3
	03/24	The Gram-Schmidt Process	§6.4
	03/26	Least-Squares Problems	§6.5
	03/26	Diagonalization of Symmetric Matrices	§7.1
12	03/31	Quadratic Forms	§7.2
	03/31	The Singular Value Decomposition	§7.4
	04/02	*Review/Catch up/Special Topics*	
13	04/07	*Review/Catch up/Special Topics*	
	04/09	*Review/Catch up/Special Topics*	
14	04/14	*Review/Catch up/Special Topics*	
	04/16	*Review/Catch up/Special Topics*	
15	04/21	*Review/Catch up/Special Topics*	
	04/23	*Review/Catch up/Special Topics*	
	04/27	**Last Day of Class**	
	04/30	**Final**	

5 Lectures

Live meetings will be held during lecture time in an online Blackboards classroom. The link for the online classroom is posted on Blackboard. Click on the classroom link and make sure you can attend live meetings. Log in with your real name. We expect that students will behave professionally during live meetings. Video recordings of live meetings will be made available on Blackboard for those who can't attend. Please make sure you continue to commit the required time to stay on track.

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6 Technical Equipment Needed

Students will need the following equipment to be able to follow classes: • a computer or tablet with working speaker or earphones (and ideally a microphone), • internet connection, • ability to log in to Blackboard for online assignments, • ability to access Blackboard classrooms to attend live meetings and watch recordings. (Note: Blackboard recordings might not work on your smartphones.) and • scanner or certain smartphone apps so that you can submit your homework as a PDF file.

For technical problems, please contact UH IT Help Desk; your instructor might not be able to help with technical issues.

Students that do not have access to the required equipment can find the needed computer equipment in the library. Additional information and technical support is available at `https://www.uh.edu/infotech`.

7 Attendance Policy

Being present during online classes is not required, but strongly encouraged. A student is considered present only if he/she has joined on time and remains until the class is dismissed.

8 Dropping Policy

01/21, 2020   Official reporting day (ORD); drop a course without receiving a grade.

04/10, 2020   Last day to drop a course with a 'W' or withdraw.

04/27, 2020   Last day of class.

If you stop participating in assignments, and do not drop, and your name appears on the final class roll, you will receive a grade of F at the end of the semester.

9 Evaluation Criteria

Students will be evaluated through homework assignments (see §9.1)and two midterm exams and one cumulative final (see §9.2). The grading criteria are described in §10. Illegible answers will be assumed to be incorrect and will receive no credit. I have not yet implemented any changes in the grading criteria other than that quizzes are dropped for now. There might be changes that will have to be implemented pending decisions from the upper administration of the University of Houston.

9.1 Homework Assignments

Homework assignments will be given on a weekly basis. There will be a total of approximately 10 homework assignments. Homework assignments will consist of exercises taken from the textbook (see §2; ''paper and pencil'') and programming exercises (Matlab; `https://www.mathworks.com/products/matlab.html`). In fairness to fellow students and graders, late homework will not be accepted. However, your lowest homework score throughout the term will be dropped to allow for missed assignments. Digital copies of your homework assignments have to be uploaded on Blackboard as a PDF every Tuesday at 10:00 am (this is a sharp deadline; no late submission will be possible). (You can use the **CamScanner App** on your preferred mobile device to create a PDF for upload if you do not have access to a scanner.) This will also be the *sharp* deadline for Matlab assignments to be submitted on Blackboard. If you do

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3

not submit your homework on time you will receive a score of zero. A list of problems will be posted by the previous Tuesday. If you cannot hand in your homework on the designated due date, make contact me by email *before the assigned due date*. Homework scores cannot be changed after one week after they have been returned.

It is expected that you express your ideas clearly, legibly, and completely, which often requires complete English sentences (i.e., a justification) rather than a long string of equations or unconnected mathematical expressions. Illegible answers will be assumed to be incorrect and will receive no credit. Homework can and should be worked on and discussed with others. Collaboration is a big part of learning and of scholarship in general. I strongly encourage you to participate in study groups with fellow students attending this course. However, your write-up of the homework has to be independent, and in your own words. Your homework needs to be complete and neatly written. I reserve the right to deduct points if these rules are not followed. There will be **no makeup homework** (see §10 and §11 for details).

To help students with the Matlab assignments I provide a GitHub repository:

- Deployment page: https://andreasmang.github.io/axisb

- Code Repository: https://github.com/andreasmang/axisb

9.2   Exams

During the semester there will be two midterm exams and one final exam. The exams will contain a mixture of computational and conceptual problems. Some of them will resemble problems you have seen in your homeworkwhile some may be brand new to you. Exams shall be worked on independently and without the use of your textbook, homework, and class notes. Illegible answers will be assumed to be incorrect and will receive no credit. There will be **no makeup exams** (see §10 and §11 for details). Exam grades can be disputed until one week after they have been returned. After that your grade cannot be changed. The exam period for the final is April 28 to May 6, 2020. The schedule for exam can be found in the schedule for the class (see §4) and, in greater detail, in §10.

Exams will have to be taken at home during a fixed time window. The exams will be made available on Blackboard. Digital copies to the solutions of the exams will have to be uploaded on Blackboard. (You can use the **CamScanner App** on your preferred mobile device to create a PDF for upload if you do not have access to a scanner.)

10   Grading

Based on the current situation I reserve the right to modify the grading system. The scheme for grading is tentative. The final grade for the class will be determined as follows:

category	percentages	points	when (duration)	where
test/midterm 1	20%	$y_1 = 200$	02/13 @ 8:30 am (75min)	CEMO 109
test/midterm 2	20%	$y_2 = 200$	04/03 @ 9:00 am (36h)	Blackboard
homework	30%	$y_3 = 300$		
final exam	30%	$y_4 = 300$	04/30 @ 8:00 am (36h)	Blackboard
total	100%	1000		

Final letter grades assigned for this course will be based on the percentage, x, of total points/semester score earned. That is,

$$x = 100\% \left(\frac{1}{1000} \left(\sum_{i=1}^{4} y_i + \text{extra credit} \right) \right), \tag{1}$$

where y_i is the points per category as found in the table above. The letter grade will be assigned as follows:

letter grade	percentage	letter grade	percentage
A	$95\% \leq x \leq 100\%$	C	$73\% \leq x < 77\%$
A−	$90\% \leq x < 95\%$	C−	$70\% \leq x < 73\%$
B+	$87\% \leq x < 90\%$	D+	$67\% \leq x < 70\%$
B	$83\% \leq x < 87\%$	D	$63\% \leq x < 67\%$
B−	$80\% \leq x < 83\%$	D−	$60\% \leq x < 63\%$
C+	$77\% \leq x < 80\%$	F	$x < 60\%$

The lowest homework score and the lowest quiz score obtained in this course will be dropped to allow for missed assignments. The lowest test/midterm exam score will be replaced by the grade of the final exam (with the appropriate 20% weighting for midterm exams), if the grade for the final exam is better. Grades for exams and homework assignments can be disputed until **one week** (7 days) after they have been returned. After that the grade cannot be changed. Grades for the

11   Makeup Policy

Not turning in homework by the assigned due dateor not taking an exam results in a **score of zero**. There will be **no makeup assignments**. Technology failures will not be accepted as reason for missed assignment due dates. Therefore, do not leave anything to the last minute. It is the student's responsibility to identify alternative ways to complete or submit an assignment. Exceptions are possible in the case of extreme circumstances, such as a documented, serious illness. In the event that a student cannot be present to turn in homework or take an exam on the day it is held the student needs to speak to me in advance, and make every attempt to do the work before (and not after) the rest of the class.

12   Academic Honesty/Honor Code

In online assignments and tests you will sometimes be asked to make an Academic Honesty Statement. University of Houston students are expected to adhere to the Academic Honesty Policy as described in the UH Undergraduate Catalog. ''Academic dishonesty'' means employing a method or technique or engaging in conduct in an academic endeavor that contravenes the standards of ethical integrity expected at the University of Houston or by a course instructor to fulfill any and all academic requirements. Academic dishonesty includes, but is not limited to, the following: Plagiarism; Cheating and Unauthorized Group Work; Fabrication, Falsification, and Misrepresentation; Stealing and Abuse of Academic Materials; Complicity in Academic Dishonesty; Academic Misconduct.

Posting answers for homework assignments online (at group chats or other online tools) is considered an academic honesty violation. Students are expected to know the difference between ''getting and/or giving help on a problem'' and ''getting/giving answers to a problem''. If a student is caught sharing answers (in person or online), they might be reported to the departmental hearing officer for an academic honesty violation. If a student becomes aware of cheating or any other violations; that student is responsible for informing the instructor.

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Refer to UH Academic Honesty website (http://www.uh.edu/provost/policies/honesty) and the UH Student Catalog for the definition of these terms and university's policy on Academic Dishonesty. Anyone caught cheating will be reported to the department for further disciplinary actions, receive sanctions as explained on these documents, and will have an academic dishonesty record at the Provosts office. The sanctions for confirmed violations of this policy shall be commensurate with the nature of the offense and with the record of the student regarding any previous infractions. Sanctions may include, but are not limited to: a lowered grade, failure on the examination or assignment in question, failure in the course, probation, suspension, or expulsion from the University of Houston, or a combination of these. Students may not receive a W for courses in which they have been found in violation of the Academic Honesty Policy. If a W is received prior to a finding of policy violation, the student will become liable for the Academic Honesty penalty, including F grades.

13 Office Hours

Office hours will take place online in one-on-one meetings. Please send me an email to make an appointment for online office hours. I will keep the former schedule for office hours (TuTh 10:00 am–11:00 am) open.

14 Late Registration

No special accommodations will be made for students who register late for this class, miss class, or are denied access to Blackboard owing to late registration. It is the sole responsibility of the student to seek out and obtain course materials or announcements if they miss class or cannot access these items through Blackboard. No make-up exams or extensions on assignments will be granted for late registration. If you do encounter problems accessing the course material, please contact the TA and instructors immediately for help, in person and via email. We are best able to help you the sooner you let us know.

15 Students Disability Services/Special Needs

If a student has a disability and would like to request classroom accommodations, please see me after class or during office hours to discuss arrangements as soon as possible (see contact information above).

Academic Adjustments/Auxiliary Aids: The University of Houston System complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, pertaining to the provision of reasonable academic adjustments/auxiliary aids for students who have a disability. In accordance with Section 504 and ADA guidelines, University of Houston strives to provide reasonable academic adjustments/auxiliary aids to students who request and require them. If you believe that you have a disability requiring an academic adjustments/auxiliary aid, please visit The Center for Students with DisABILITIES (CSD) website at http://www.uh.edu/csd for more information.

Accommodation Forms: Students seeking academic adjustments/auxiliary aids must, in a timely manner (usually at the beginning of the semester), provide their instructor with a current Student Accommodation Form (SAF) (paper copy or online version, as appropriate) from the CSD office before an approved accommodation can be implemented.

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Details of this policy, and the corresponding responsibilities of the student are outlined in The Student Academic Adjustments/Auxiliary Aids Policy (01.D.09) document under [STEP 4: Student Submission (5.4.1 & 5.4.2), Page 6]. For more information please visit the Center for Students with Disabilities Student Resources page.

Additionally, if a student is requesting a (CSD approved) testing accommodation, then the student will also complete a Request for Individualized Testing Accommodations (RITA) paper form to arrange for tests to be administered at the CSD office. CSD suggests that the student meet with their instructor during office hours and/or make an appointment to complete the RITA form to ensure confidentiality. RITA forms must be completed at least 48 hours in advance of the original test date. Please consult your counselor ahead of time to ensure that your tests are scheduled in a timely manner. Please keep in mind that if you run over the agreed upon time limit for your exam, you will be penalized in proportion to the amount of extra time taken.

16   Mental Health/CAPS Statement

Counseling and Psychological Services (CAPS) can help students who are having difficulties managing stress, adjusting to college, or feeling sad and hopeless. You can reach CAPS (http://www.uh.edu/caps) by calling 713-743-5454 during and after business hours for routine appointments or if you or someone you know is in crisis. No appointment is necessary for the ''Let's Talk'' program, a drop-in consultation service at convenient locations and hours around campus. http://www.uh.edu/caps/outreach/lets_talk.html.

17   Help

CASA offers tutoring for mathematics students, and proctored testing for students in all subject areas. The CASA Tutoring Center offers tutoring to all students enrolled in undergraduate mathematics courses. It is located in room 222 — Garrison Gym. During weekdays, the Department of Mathematics offers tutoring for more advanced-level, undergraduate math courses. Tutoring sessions are located in M.U.S.L. 11 Fleming (basement). Tutoring hours are subject to change, so please check the dedicated websites before planning your schedule. More information on tutoring services, including scheduling information, can be found here: http://www.uh.edu/nsm/math/undergraduate/academic-assistance/Support-and-Tutoring.

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7