

MATH 201

Linear Algebra

Sabancı University, Spring 2020-2021

This syllabus may be subject to update and change.

Instructor: Nilay Duruk Mutlubas

Lecture hours: Tuesday 08.40-09.30 and Thursday 08.40-10.30

Lecture format: Lectures will be live-streamed (Tuesday and Thursday) unless a technical difficulty occurs. You can find the Zoom link for the lecture on SUCourse+. In order to have access, you must be logged in with your Sabancı account. The online lectures will be recorded and uploaded afterwards, so that you can also watch them at a later time. They are going to be published on SUCourse+ via Google Drive. Supplementary materials will also be uploaded on SUCourse+ to study before/after the lectures.

Recitation Hours:

Thursday 16.40-17.30: A1 - A5

Thursday 17.40-18.30: B1 - B5

Recitation format: Recitations will be live-streamed and held as discussions with the TAs via Zoom. You can find the Zoom links for recitations on SUCourse+. In order to have access to them, you must be logged in with your Sabancı account. Students must attend the online recitation classes to which they are registered.

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Office Hours: Tuesdays 15.40-16.30 or make an appointment by e-mail. In both cases will be held online via Zoom.

You are responsible for every announcement made in class or in SUCourse+. Not attending the class or not following SUCourse+ regularly is not an excuse, in case you miss something.

Course Content

Systems of linear equations, Gaussian elimination, vector spaces, subspaces, linear independence, dimension, change of bases, linear transformations, determinants, eigenvalues, eigenspaces, diagonalization, inner product and orthogonality.

Course Materials

- G. Strang, Introduction to Linear Algebra. Fifth edition (2016) Wellesley-Cambridge Press and SIAM
- Anton H., Rorres C., Elementary Linear Algebra with supplemental applications, Wiley International Student Version, 11th edition, 2015.
- Bretscher O., Linear Algebra with Applications, 2nd Edition, Prentice-Hall, 2001.
- Poole D., Linear Algebra: A Modern Introduction 3rd Edition, Brooks Cole, 2011.
- Leon, S. J., Linear Algebra with Applications, 9th Edition, Prentice Hall, 2014.
- Kolman B., Hill D., Elementary Linear Algebra with Applications, 9th edition, Prentice-Hall, 2008.
- Weintraub S.H., Linear Algebra for the Young Mathematician, AMS, 2019.
- Takahashi S, Inoue I, The Manga Guide to Linear Algebra, 2012.

Objectives

This course aims to introduce basic concepts of linear algebra such as vector spaces, bases, linear transformations, eigenvalues and eigenspaces. The course gives students training to develop their mathematical skills, analytical and critical thinking abilities, their ability to apply these capabilities to practical problems, and to communicate their knowledge of these areas.

Course Outline

- Week 1-5: Introduction to vectors, linear combinations, systems of linear equations, solving linear equations, matrices, matrix operations, inverse matrices,
- Week 6-8: Vector spaces and subspaces, subspace criteria, linear independence, basis, dimension,
- Week 9-10: Linear transformations, matrix representation, change of bases,
- Week 11: Determinants, properties, Cramer's rule,
- Week 12: BAYRAM HOLIDAY
- Week 13: Eigenvalues, eigenvectors, diagonalization,
- Week 14: Orthogonality, orthonormal bases, Gram-Schmidt process.

Learning Outcomes

On completion of this course the student should be able to:

- Understand the notion of mathematical thinking, mathematical proofs, and able to apply them in problem solving.
- Present simple proofs in a precise and formally correct way.
- Solve a system of linear equations using matrix reduction.
- Do basic arithmetical operations with matrices.
- Understand the notions of linear independence, basis and dimension of a vector space.
- Find a basis and dimension of Euclidean or abstract vector spaces.
- Geometrically interpret the above concepts.
- Represent linear transformations as matrices and, conversely, interpret matrices as linear maps.
- Compute eigenvalues and eigenspaces of matrices.
- Identify whether a matrix is diagonalizable or not.

Grading

Your grade exclusively depends on the below listed items. **There will be no other extra-credit opportunities.**

- **Midterm exam (35%):** 24.04.2021 Saturday @ 13.00
- **Final exam (35%):** 29.05.2021-10.06.2021. Exact date will be announced by student resources. Further details will be announced on SUCourse+ before the exams.

Both exams will be online proctored and recorded. For proctored exams, your webcam and microphone should be on during the exam. In the case of non-compliance with this and other declared exam procedures, your exam will be void. Make sure to check that your webcam and microphone function properly before the exam.

- **Worksheets (20%):** There will be 8 worksheets to be solved in total and best 5 will be counted, therefore each worksheet worths 4 points. The worksheets will be provided during recitations and students will be asked to upload the first draft of their solutions of a worksheet, on SUCourse+. Final version of the solutions are expected to be uploaded on SUCourse+ each following Monday **latest** at 10.00 a.m. The first draft will be granted 2 points if it is an ok solution of at least 50% of the worksheet. This final version is granted 2 more points if it contains ok solutions for the entire worksheet. If no final version is uploaded, the first draft will be considered as such, and then evaluated. If no first draft is uploaded, final draft will not be graded. If a student does not attend recitation class but submit final draft, it will not be graded. **There will be no make-up for the worksheets.** Teaching assistants will provide feedbacks for the worksheet problems after final draft submissions are completed. Students found having a behaviour in contrast with Academic Integrity multiple times, will receive 0 (zero) point.

Warning 1: Every document that requires a student submission,

- i. must be in **pdf** format, and **hand-written**,
- ii. must have **name, surname, student ID, and signature** on the top left corner of the document **on each page** submitted,
- iii. **Sabancı Student ID card or a valid ID card with name and photo on it** must be placed on the top right corner of the **first page**.
Submissions must be uploaded as a single pdf file. Any submission that is not in the described format will **NOT** be taken into account. Moreover, any solution that contains notations that are not used in the lectures/recitations will be completely ignored.

Warning 2: After any submission (i.e. online assignments, midterm exam, final exam), some of the students may be called for an oral examination. In this case, some students will be selected randomly and some will be selected based on any irregularities in their performance and/or level of work they submit. Oral examinations will be done over Zoom and each oral examination will be recorded. During an oral examination, students must

- (i) keep their camera on at all times,
- (ii) share their entire screens (not specific tabs or windows).

Performance of the student in an oral examination will affect their grades of the grading item they have been called upon. If a student fails to show up at an oral exam, or does not obey the aforementioned rules, (s)he will automatically get 0 (zero) point from that grading item.

- **Lecture attendance (5%):** Attendance is checked using the log files of Zoom. You are required to register a Zoom account using the sabanciuniv.edu mail address provided by the university. Log data related to other mail addresses will be ignored. Moreover, in-class quizzes will be given randomly to check lecture attendance. These quizzes will be given as either Zoom poll or Tophat question (Course code: 999359). Make sure that you have a Tophat account with your sabanciuniv.edu address. **There will be no make-up for those quizzes.** Best 70% percent of them will be counted. Students with time conflicts, please see the Registration Overrides section of the syllabus.
- **Recitation attendance (5%):** Attendance is checked using the log files of Zoom. You are required to register a Zoom account using the sabanciuniv.edu mail address provided by the university. Log data related to other mail addresses will be ignored. Students must attend the recitation classes to which they are registered. If anyone feels that change in recitation section is necessary, s/he should contact us. Recitations are supposed to be an active learning environment. Your behavior will be monitored by the TA's. If you misbehave during recitations (disturbing your classmates, being late, leaving early during online classes) this will be reported to the instructor and appropriate measures will be taken, which may effect your course grade. In order to follow worksheets, discussions and solved problems, you are supposed to attend recitation classes. While preparing first draft of the worksheets, students must actively be there for an hour and should not leave early, otherwise they will be considered absent. Best 7 attendance checks will be counted for the final recitation grade.

Warning: The passing grade will be determined after the final exam. Be aware that this passing grade may not match the overall average of the students.

Make-up Policy

Make-ups are only allowed for the midterm and the final examinations. Since there is limited access to health services during this period, any verbal (and legitimate) excuse can be accepted, provided that you contact the instructor beforehand. Any excuses that will be taken into the instructor's account **after** the exam will not be considered. **No exceptions to these rules.** The make-up exam will contain **all topics** covered throughout the semester. The make-up examination will be done as a combination of face-to-face online verbal exam and written exam at the end of the semester. One can have a make-up exam for **ONLY** one of the exams. If a student miss both (Final and Midterm) exams even with a valid excuse, then (s)he will be allowed to take make-up for Final exam only, and receive 0 (zero) point for Midterm exam. **If the student do not contact with the instructor and do not take neither the exams nor the make-up, then (s)he gets NA (even though worksheets and attendance checks appear in the grading).**

Academic Honesty

We expect all students to follow common-sense practices during the exams. In particular, no form of cheating is welcome in the exams or quizzes, such as copying whole or part of each other's answers, using cheat-sheets etc. The action against such violations could range from getting a zero on the particular exam to explaining the case in front of the Disciplinary Committee.

For more information visit <https://www.sabanciuniv.edu/en/academic-integrity-statement>

Class Discipline

It is our responsibility to provide students with excellent teaching and learning environments. We are therefore asking you to respect both our responsibility to teach and the right of other students to learn. Any action that disturbs your classmates or disrupts the online activities is unacceptable. Repeated violations of the above common sense rules may cause a student to be counted as absent for a lecture or a recitation.

Suggestions

- Study regularly and attend all lectures and recitation sessions. Make sure you attend your own (registered) recitation section.
- Feel free to ask me and your TA questions in and out of class, especially during office hours.
- Math 201 is a combination of computational mathematics and theoretical mathematics (that is abstract definitions and Theorems). The computational aspects of the course will feel more familiar and easier to grasp, but we will also focus on the theoretical aspects of the subject. Whenever you encounter an abstract concept in the lecture, take a pause and give yourself some time to think about it.
- In linear algebra, definitions and Theorems build on each other quickly. If you fall behind, it will be difficult to catch up. Work hard from the beginning, and come to office hours immediately if you do not understand something. Studying out of class for this course should become a routine. Key to success in mathematics is practice.

Registration Overrides

Time conflict requests will be accepted if you do not exceed one hour. However, any and all negative outcomes that may result are solely the student's responsibility.