MATH-UA 140
Spring 2021

- **Lecturer:** Dr. Charmaine Sia
  - e-mail: sia@cims.nyu.edu
  - Office hours: Tuesdays 2:00–3:00 pm, Wednesdays 11:00 am–12:00 pm or by appointment
- **Teaching assistants**
  - Simon Harris, sh5653@nyu.edu, office hours: Tuesdays 6:00–7:00 pm, Thursdays 10:00–11:00 am on Zoom
  - Liangchen Liu, ll4155@nyu.edu, office hours: Wednesdays 10:00–11:00 am and 7:00–8:00 pm or by appointment on Zoom
- **Course information**
  - Lecture time and location: Tuesdays & Thursdays 12:30–1:45 pm on Zoom
  - Recitation time and location: You must register for one of the following recitation sections.
    * 007/BRC1: Fridays 8:00–9:15 am in Warren Weaver Hall 109/on Zoom with Simon Harris
    * 008/BRC2: Fridays 9:30–10:45 am in Warren Weaver Hall 109/on Zoom with Simon Harris
    * 009/BRC3: Fridays 11:00–12:15 am in Warren Weaver Hall 109/on Zoom with Liangchen Liu
    * 010/BRC4: Fridays 12:30 pm–1:45 pm in Warren Weaver Hall 109/on Zoom with Liangchen Liu

    There is no recitation during the first week.
  - Recordings of lectures and recitations will be available on NYU Classes. Nevertheless, you are expected to have signed up for a section time at which it is convenient for you to attend synchronously.
  - Course websites:
    * NYU Classes
    * Campuswire:

      Course-related questions should be asked on Campuswire. Note that asking and answering questions can be done privately or anonymously to other students if you wish. You are encouraged to answer each other's questions, as that will promote a collaborative learning environment.
    * OneNote lecture notes
  - Textbook: Gilbert Strang, *Introduction to Linear Algebra*, 5th edition, Wellesley-Cambridge Press, 2016

    You are expected to read the relevant section(s) of the textbook before each lesson.

- **Course outline**
  - Linear algebra is a cornerstone of any mathematics curriculum for two important reasons:
    1. Because the theory of linear algebra is well understood, a first step in many areas of applied mathematics is to reduce the problem into one in linear algebra.
    2. Vector spaces and linear operators studied in linear algebra are found in many different areas of mathematics, science and engineering.

    Students will leave the course with computational ability and conceptual understanding of solving linear equations, vector spaces and subspaces, orthogonality, determinants, eigenvalues and eigenvectors, linear transformations and matrix factorizations (such as LU, QR and SVD).

- **Grade breakdown and test dates**
  - Homework to be (scanned and) submitted as a single PDF file on Gradescope (https://www.gradescope.com/): 15%, usually due weekly on Thursdays at 11:59 pm New York time.
  - Quizzes: 10%, administered via Gradescope weekly on Fridays, except in the first week of recitation and weeks of examinations. Quizzes should be accessed on Gradescope between 12:00 am to 11:59 pm New York time on Fridays, with a time limit of 20 minutes to complete a quiz after first opening it. Quizzes will test topics covered during the previous week.
  - Asynchronous assessments: 20%. 7 lectures will be taught partially asynchronously in a flipped format. For these lectures, you should watch an assigned video and read the relevant section(s) of the textbook before the lecture. Lectures will meet for 45 minutes on those days. After the lecture, you should complete a timed open-book assessment on Gradescope on the material covered which will be due by 11:59 pm the following day.
  - Midterm examination 1: 17.5%, in class on Tuesday, March 16, 2021.
  - Midterm examination 2: 17.5%, in class on Thursday, April 15, 2021.
  - Final examination: 20%, date and time TBD. All sections of Linear Algebra take different final examinations at different times.
  - No extra credit projects will be offered.

- **Homework, quiz and examination policy**
  - Guide to submitting homework on Gradescope: https://www.gradescope.com/get_started#student-submission. Homework submitted by e-mail will not be accepted unless the lecturer granted an extension beyond the due date on Gradescope.
  - Late homework will not be accepted. This includes homework which the file metadata indicates was created before the deadline but which was not submitted on time.
  - You are granted a single one-day homework extension during the semester: the first homework submitted within a day after the due date will be graded as submitted on time for credit. Subsequent homework submitted within a day after the due date will be graded but not for credit. Homework submitted more than a day after the due date will not be graded. If a homework is resubmitted, the last resubmission time will be regarded as the submission time.

- Other homework extensions may be granted in cases when the lecturer has good reason to believe that you may have difficulty completing homework on time even with proper time planning (e.g. joined the course late or prolonged illness). Please e-mail the lecturer well in advance and explain your reason(s) if you would like to request other homework extensions, and note that other homework extensions are not automatically granted.
- You are permitted to discuss homework with fellow students, but homework must be written in your own words.
- In one lecture, you will be introduced to doing linear algebra using the programming language Python. Please download the distribution Anaconda for a complete scientific Python environment and familiarize yourself with Jupyter Notebooks. Prior programming experience is not required.
- Missed quizzes will not be made up. If a quiz is missed for a valid reason (documented illness, university-sanctioned event, religious holiday or emergency), the percentage of the total grade which that quiz constitutes will be distributed among the remaining quizzes. This will be represented in the Gradebook by a blank (as opposed to 0) score. You must e-mail the lecturer and teaching assistant documentation for missing a quiz for a valid reason for a score of 0 to be changed to a blank score.
- The lowest homework score and lowest quiz score will be dropped.
- Only a limited number of out-of-sequence examinations can be accommodated due to limited availability of proctors. Out-of-sequence examinations may be approved in the following cases:
  - Documented medical excuse
  - University-sponsored event such as an athletic tournament or a performance, or certain other non-rescheduleable academic- or career-related activities such as a job interview or graduate school visit. Athletic practices and rehearsals do not qualify. Please request a supervisor or faculty advisor to contact the lecturer, or consult with the lecturer whether your non-reschedulable academic- or career-related activity qualifies.
  - Religious holiday
  - Extreme hardship such as a family emergency

  Out-of-sequence examinations will not be accommodated for purposes of more convenient travel, including already purchased tickets. Scheduled out-of-sequence examinations (those not arising from emergencies) must be taken before the actual test. Please contact the lecturer at least a week in advance to schedule them.
- If you miss an examination due to an emergency, you must e-mail the lecturer written documentation within 2 days of the missed examination or immediately after you return to school.
- Graded assignments and tests will be returned on Gradescope. If you have any questions about the grading of an assignment or test, please contact the lecturer or submit a regrade request within a week of having it returned; regrade requests will not be considered after that. Questions regarding quiz grading should be directed to your teaching assistant first.
- Examinations will be video-proctored. If you do not have access to technology to participate in the course smoothly, please inform the lecturer as well as Andrew Greene (andrew.greene@nyu.edu), the Senior Educational Technologist for the FAS Office of Educational Technology.

- **Other resources**
  - Free tutoring at Mathematics Department Undergraduate Tutoring Center: https://math.nyu.edu/dynamic/undergrad/tutoring/
  - Free tutoring at University Learning Center: https://www.nyu.edu/ulc
- **Academic integrity**
  - You are expected to follow codes of academic integrity as specified by the university and the College of Arts and Sciences:
    * https://www.nyu.edu/about/policies-guidelines-compliance/policies-and-guidelines/academic-integrity-for-students-at-nyu.html
    * https://cas.nyu.edu/content/nyu-as/cas/academic-integrity.html
    * http://cas.nyu.edu/content/nyu-as/cas/academic-integrity/honor-code.html

MATH-UA 140: Linear Algebra
Schedule

Topics marked with an asterisk (∗) indicate partially asynchronous lectures: you should watch a video before the lecture and the lecture will meet for 45 minutes that day.

Date	Section in textbook	Topic(s)
01/28/2021	1.1–1.2	Vectors and Linear Combinations & Lengths and Dot Products
02/02/2021	1.3	Matrices
02/04/2021	2.1–2.2	Vectors and Linear Equations & The Idea of Elimination
02/09/2021	∗ 2.3–2.4	Elimination Using Matrices & Rules for Matrix Operations
02/11/2021	2.5	Inverse Matrices
02/16/2021	∗ 2.6–2.7	Elimination = Factorization: $A = LU$ & Transposes and Permutations
02/18/2021		*No class (Legislative Day - Monday schedule)*
02/23/2021	3.1	Spaces of Vectors
02/25/2021	3.2	The Nullspace of A: Solving $Ax = 0$ and $Rx = 0$
03/02/2021	∗ 3.3	The Complete Solution to $Ax = b$
03/04/2021	3.4	Independence, Basis and Dimension
03/09/2021	∗ 3.5–4.1	Dimensions of the Four Subspaces & Orthogonality of the Four Subspaces
03/11/2021		Review for midterm examination 1
03/16/2021		Midterm examination 1
03/18/2021	4.2	Projections
03/23/2021	4.3	Least Squares Approximations
03/25/2021	4.4	Orthonormal Bases and Gram-Schmidt
03/30/2021	∗ 5.1–5.3	The Properties of Determinants & Permutations and Cofactors & Cramer's Rule, Inverses, and Volumes
04/01/2021	additional	Introduction to Linear Algebra in Python
04/06/2021	6.1	Introduction to Eigenvalues
04/08/2021	6.2	Diagonalizing a Matrix
04/13/2021		Review for midterm examination 2
04/15/2021		Midterm examination 2
04/20/2021	∗ 6.4–6.5	Symmetric Matrices & Positive Definite Matrices
04/22/2021	7.1–7.2	Image Processing by Linear Algebra & Bases and Matrices in the SVD
04/27/2021	7.3–7.4	Principal Component Analysis (PCA by the SVD) & The Geometry of the SVD
04/29/2021	∗ 8.1–8.2	The Idea of a Linear Transformation & The Matrix of a Linear Transformation
05/04/2021	8.2–8.3	The Matrix of a Linear Transformation & The Search for a Good Basis
05/06/2021		Review for final examination
		Final examination (date and time TBD)