Fall 2021 GA 2111 Linear Algebra Syllabus

Contact Information

Instructor: Weilin Li  
Email: weilinli@cims.nyu.edu  
Office hours time: Wednesday 4 pm – 6 pm  
Office hours location: Courant Institute, Warren Weaver Hall, Room 604

Meeting Times

Lecture time: Thursday, 9:00 – 10:50 am  
Lecture location: Courant Institute, Warren Weaver Hall 1302  
No lecture on Thursday, November 25 due to Thanksgiving break

Textbooks


Other useful texts:


Prerequisites

Undergraduate linear algebra (Math 140 at NYU) is required. Students are expected to be able to read and write proofs. Experience with upper level undergraduate math courses (e.g., real and complex analysis, abstract algebra) is strongly recommended.

Goals and Content

This is a graduate level linear algebra course for students who are currently or planing on pursuing an advanced degree in a quantitative field. We will first rigorously cover the fundamental topics of linear algebra such as vector spaces, duality, linear transformations, and norms. One main focus of this course is on spectral theory and matrix factorization. Another main focus is on solving systems of equations. This is a fast paced course and students are required to spend significant time filling in details omitted from lecture and working on homework exercises.
Communication and Software

- Lecture will be held in person unless otherwise mandated by the university. All students are expected to come to class. Lectures will **not** be streamed online or recorded.
- Lecture notes, written homework assignments, solutions, and important announcements will be posted on **NYU Brightspace**.
- Homework will be submitted and graded electronically via **Gradescope**.
- If you have math questions, it is best to speak in person either during office hours or immediately after lecture. You do not need to set up an appointment to come to office hours – just drop by.
- If you need to contact me outside of lecture and office hours, it is best to email me. Please do not send me messages through NYU Brightspace.

Tentative Calendar

We will cover roughly the following topics in the listed order.

<table>
<thead>
<tr>
<th>Chapters in Lax</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1–2</td>
<td>Linear spaces and duality</td>
</tr>
<tr>
<td>3–4</td>
<td>Linear maps and matrices</td>
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<tr>
<td>5</td>
<td>Determinant, trace</td>
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<td>7</td>
<td>Inner product spaces</td>
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<tr>
<td>14–15</td>
<td>Vector and matrix norms</td>
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<tr>
<td>6</td>
<td>Eigenvalues and eigenvectors</td>
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<tr>
<td>8</td>
<td>Spectral theory for normal matrices</td>
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<tr>
<td>6</td>
<td>Diagonalization, Jordan canonical form</td>
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<tr>
<td>9*</td>
<td>Analytic approach to spectral theory</td>
</tr>
<tr>
<td>10*</td>
<td>Other matrix factorizations</td>
</tr>
<tr>
<td>18*</td>
<td>Solving systems of equations</td>
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<tr>
<td>18*</td>
<td>Matrix perturbation theory</td>
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Chapters marked with a * means that Lax includes some relevant, but not sufficient, material. Other references may be provided. These topics will only be covered time permitting.

Course Components and Grading

**Written Homework (70%)**

There will be several written homework. No late homework is accepted, except for qualifying emergencies (refer to the sick and late policy below). Submit your best of work even if you are not able to fully solve a problem, as partial credit will be rewarded.

While collaboration is highly encouraged, each student is responsible for writing up his/her solutions individually. Direct copying of another student’s homework, even if all students contributed, is considered a violation of academic integrity.
Homework should be written clearly and proper justification is required. For an idea of what constitutes a rigorous and complete proof, students should consult uploaded solutions.

**Exams (30%)**

There will be a take-home final exam at the end of semester (details TBA). The exam is to be completed individually. Any cheating will result in a zero and will be reported to the math department and office of academic integrity.

**Sick and Late Policy**

Late homework and exams are not accepted, except for any of the following reasons.

- Religious holiday: contact me at least one week prior to the deadline to discuss make-up options.
- Qualified academic activity: have your coach or faculty member send me an email entailing the academic activity at least one week in advance.
- Family emergency or sickness: contact me ASAP to discuss make-up options. Any students who contract COVID are **not** required to disclose.

In general, late homework must be made-up within **three days** of the original due date, so that solutions can be posted online in a timely manner. If the qualifying reason prevents you from completing the assignment within three days, other alternatives will be discussed.

**Accommodations**

If you have an academic disability or condition that requires accommodation, please let me know ASAP and register with the [Moses Center](#).

**Academic Integrity**

Academic integrity rules are strictly followed and enforced.