



# Course Description

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## Linear Algebra

Department of Computer Engineering

Sharif University of Technology

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# Machine Learning Mathematics



Data Scientist and Data Science



GAN: Adversarial training



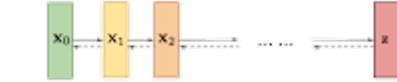
VAE: maximize variational lower bound

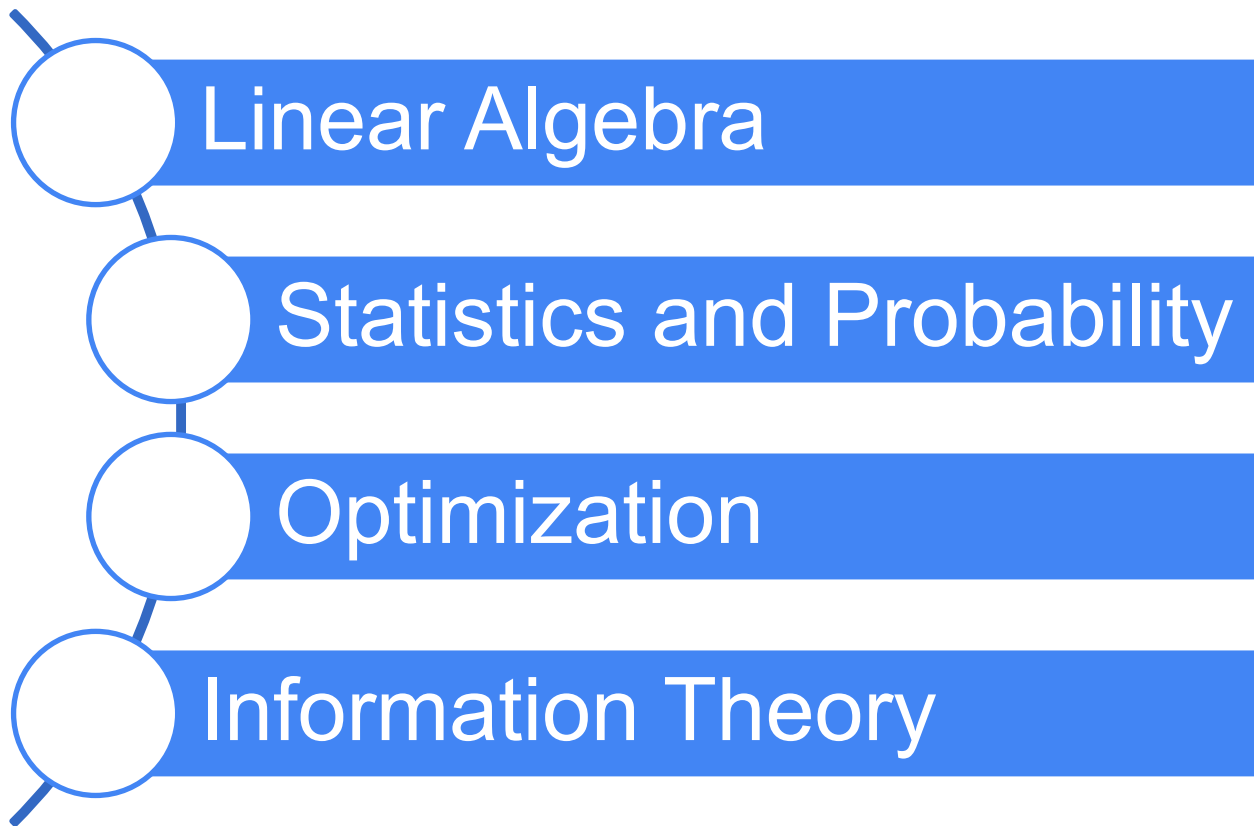


Flow based models: Invertible transform of distributions



Diffusion models: Gradually add Gaussian noise and their reverse





## □ [Jabrekh.Github.io](#)

[Linear Algebra](#) [Home](#) [Materials](#) [Assignments](#) [Problem sets](#)

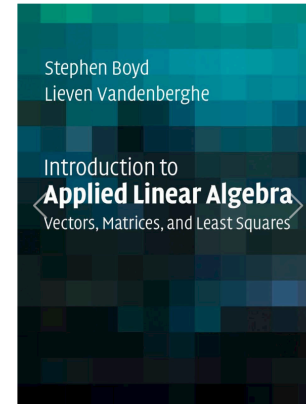
## CE282: Linear Algebra

Spring 2024, Group 1; Computer Engineering Department, Sharif University of Technology, Tehran, Tehran Province, Iran

Classes: Sundays and Tuesdays, 15:00-16:30, Hall 1

This course covers matrix theory and linear algebra, emphasizing topics useful in other disciplines. Linear algebra is a branch of mathematics that studies systems of linear equations and the properties of matrices. The concepts of linear algebra are extremely useful in image processing, computer vision, data science, machine learning, bio-informatics, social networks, and neuroscience. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.

[Syllabus](#)



### Instructors



#### Hamid R. Rabiee

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#### Maryam Ramezani

PhD Candidate, Guest Lecturer

Office CE803 and CE802

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Slides:

Example

Definition

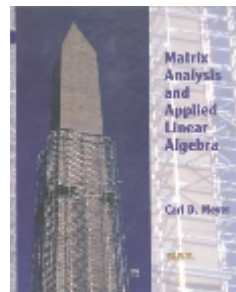
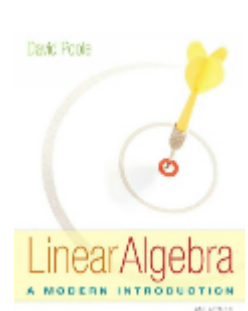
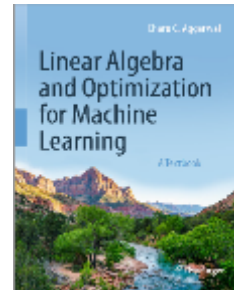
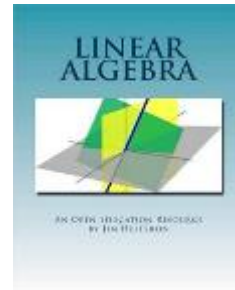
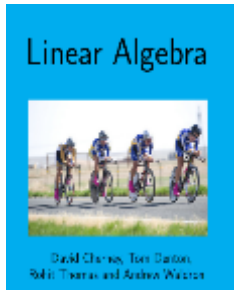
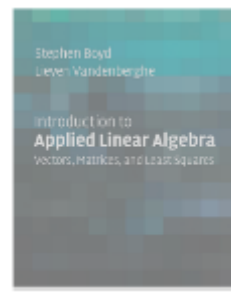
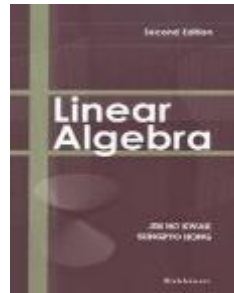
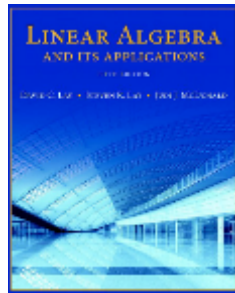
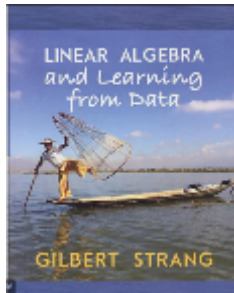
Notes

Theorem

Board

Geometric Interpretation and Intuition

# Course References





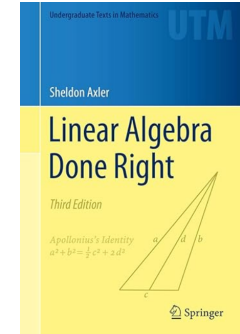
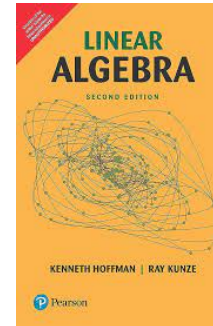
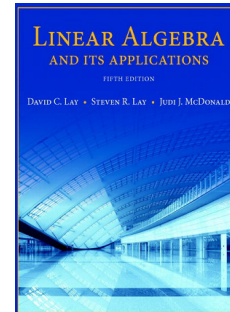
- ❑ Office Room: CE802–CE803
- ❑ Email:
  - Hamid R. Rabiee: ([rabiee@sharif.edu](mailto:rabiee@sharif.edu))
  - Maryam Ramezani: ([maryam.ramezani@sharif.edu](mailto:maryam.ramezani@sharif.edu))
- ❑ Course notes, homework and solutions, handouts, and other useful resources are available on the Quera page:
  - <https://quera.org/course/?/>
  - Room: (Sunday & Tuesday: 15:00-16:30)
  - Hall Number 1
  - <https://vc.sharif.edu/ch/rabiee>
- ❑ Lead TA:
  - Naser Kazemi: ([naserkazemi2002@gmail.com](mailto:naserkazemi2002@gmail.com))
- ❑ Feedback
  - <https://forms.gle/FU9gjMXh65c6fyLr5>



## □ Textbooks:

- Sheldon Axler, Linear Algebra Done Right, fourth edition, 2023
- Kenneth Hoffman and Ray A. Kunze. Linear Algebra. PHI Learning, 2004.
- Gilbert Strang. Introduction to Linear Algebra. Wellesley–Cambridge Press, 2016.
- David C. Lay, Steven R. Lay, and Judi J. McDonald. Linear Algebra and Its Applications. Pearson, 2016.

+Other textbooks and course materials.







## ❑ Lectures

- **Goal:** To introduce concepts in linear algebra, and motivate their use and importance.
- **Note:** We try to cover useful materials in class, but we recommend you reading more!

## ❑ Assignments

- **Purpose:** To give you a chance to exercise your mind, and to solidify the concepts introduced to you in class.
- **Outline:** Eight theoretical homework, and one four practical homework.
- **Structure:** Four theoretical problems, and one or two linear algebra practical problems.
- **Importance:** Not important unless you want to learn the material and get a good grade.

## ❑ Exams: Two Midterms + Final



- ❑ Lecture slide will be uploaded.
- ❑ Many times we will write on board, in real-time, during lecture to prove a theory or answer a question or add some additional explanations. It will be your responsibility to take notes.
- ❑ Slides links will be provided on site.



- ❑ Four Theory Questions
- ❑ One or Two Practical Questions
  - Basic Python for programming
  - Basic NumPy for array manipulation
  - Basic programming with Pytorch
  - Learning linear algebra and application of machine learning.
- ❑ Assignments will be released on midnight of the day the last topic of the homework has been lectured. Students will have 10 days for theoretical and almost 20 days for practical assignments to submit answers in the Quera.
- ❑ Homework Upload:
  - <https://quera.org/course/14555/>



Assignment	Release	Submission	Solution Release	
TH1	1402/12/01	1402/12/11	1402/12/14	10 Days
TH2	1402/12/15	1402/12/25	1402/12/28	10 Days
TH3	1402/12/27	1403/01/17	1403/01/20	20 Days
TH4	1403/01/21	1403/01/31	1403/02/03	10 Days
TH5	1403/02/02	1403/02/12	1403/02/15	10 Days
TH6	1403/02/16	1403/02/26	1403/02/29	10 Days
TH7	1403/02/30	1403/03/09	1403/03/12	10 Days
TH8	1403/03/13	1403/03/23	1403/03/25	10 Days
PR1	1402/12/15	1403/01/31	1403/02/03	45 Days
PR2	1403/01/21	1403/02/12	1403/02/15	22 Days
PR3	1403/02/16	1403/03/09	1403/03/12	24 Days
PR4	1403/03/13	1403/04/03	1403/04/06	21 Days

**Important:** Note that this schedule is tentative and may be affected by unforeseen circumstances.



## □ TA class:

- Problem solving classes: Can be discussed.
- Exams Exclusive classes: In particular, for each of the midterm and the final exam, a TA class will be held so that students can prepare adequately for the exam.
- Python workshops: For those students who are not familiar with Python and its related libraries, four workshop classes will be held to cover Python, NumPy and visualization libraries.
- Virtual Class
- <https://vc.sharif.edu/ch/rabiee-ta>

Date	Title
1403/01/22	Midterm 1
1403/02/26	Midterm 2
1403/03/30	Final

# Grading Scheme



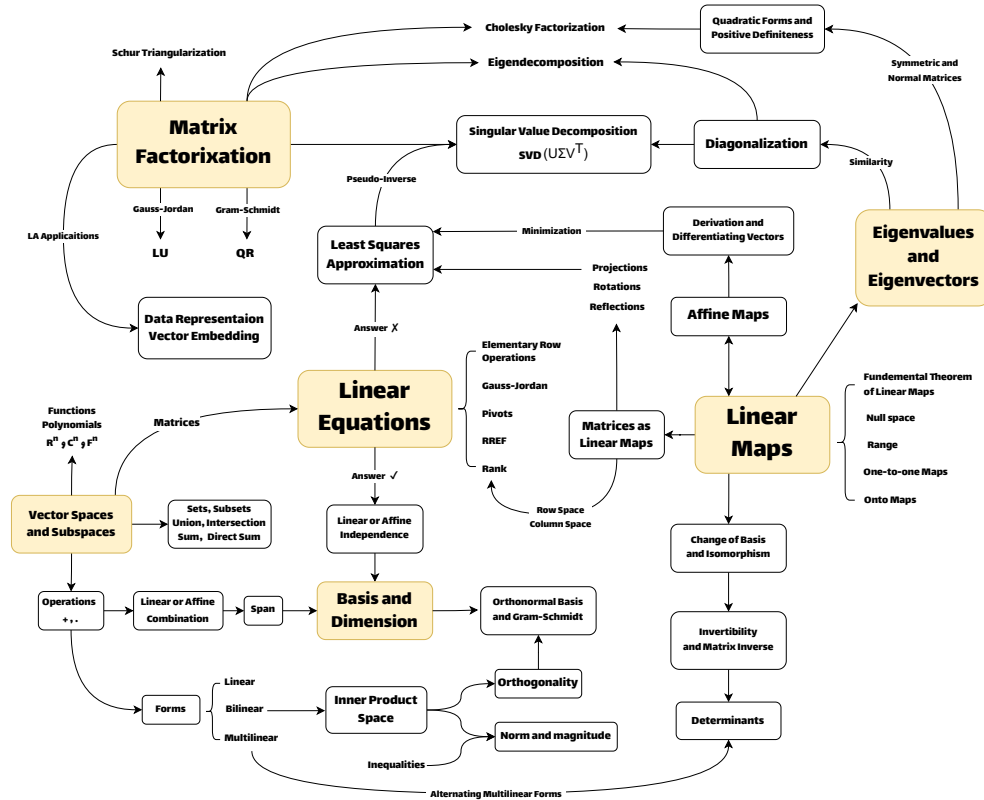
Item	Grade
Homework	45% (9 points)
Midterm Exams	35% (3.5+3.5 points)
Final Exam	25% (5 points) (Comprehensive)
<b>Total</b>	<b>21</b>

- ❑ Mid-Term 1 Exam: 17.5% (1403/01/23 09:00)
- ❑ Mid-Term 2 Exam: 17.5% (1403/02/27 09:00)
- ❑ Final Exam: 25% (Comprehensive) (1403/03/31 15:30)



- ❑ Homework and Project: 45%
  - Homework Assignments: 9 points, 8 series of theoretical and 4 series of practical homework assignments. Each theoretical and practical assignment is graded from 0.75 points with extra and 0.5 points, respectively.
  - You have a total **16 days of allowed late** submission (for both theoretical and code part). **0.5%** of the assignment grade will be subtracted for each **hour of delay**
- ❑ For each homework, you can use your late submission up to **3 days**.
- ❑ Discussing the problems with each other is encouraged. Copying each others assignments or submitting solutions/answers on the web is strictly prohibited. First time, you **will receive -100% of grade for the task at hand**. If you are caught for a second time, **you will fail the course**.

# Course Roadmap



Radin Shahdaei