Matrices and Linear Transformations (21-241)

Laurent Dietrich

Carnegie Mellon University, Fall 2016, Sec. F and G

Class info	**Instructor info**
Time: MWF 12:30pm–1:20pm	*Instructor:* Laurent Dietrich
Location: Wean Hall 5403	*Office:* Wean Hall 7128
Units: 10	*Email:* ldi@cmu.edu

1 Course content

1.1 Introduction

Linear algebra is the study of systems of linear equations. As those are the simplest equations one can think of, they are often a good description – at least in a first approximation – of real phenomena from all the sciences, and that is why their study is so important. Due to their nature, they are also a very important block that is common to all branches of mathematics itself. This course is intended for scientists, engineers, mathematicians and computer scientists. Students will be required to write some straightforward proofs. We will adopt a tradeoff between computations and more theoretical aspects. 21-127 is strongly recommended.

1.2 Learning objectives

By the end of the course you should be able to :

(1) Use standard mathematical notations and terminology in linear algebra (systems, matrices, vectors, vector spaces) and logical reasoning.

(2) Recall and explain basic definitions and theorems.

(3) Accurately do standard computations (products of matrix-matrix, matrix-vector, dot produt, cross product, determinants, change of basis).

(4) Reduce linear algebra questions to such systems (almost everything until eigenvalues problems).

(5) Apply standard techniques such as Gaussian elimination to solve such systems and accurately describe the set of solutions.

(6) Find eigenvalues and eigenvectors and diagonalize matrices.

Figure 1: A game in a magazine I read on the beach. Find the value of each symbol, knowing that each line has a value of 9.

1.3 Topics covered

Real and complex vectors and matrices, vector spaces, rank and nullity, solving linear systems by row reduction of a matrix, inverse matrices and determinants, change of basis, linear transformations, inner product of vectors, orthonormal bases and the Gram-Schmidt process, eigenvectors and eigenvalues, diagonalization of a matrix, symmetric and orthogonal matrices.

1.4 Material

- *Linear Algebra, A Modern Introduction* by David Poole.

I will use the 4th edition. You can use the previous ones but make sure that the correspondence is right when some assignment comes from the book.

2 Assessment and grades

- Homework assignments (20% of final grade) (1 per week)

- Midterm exams (20% of final grade per midterm) (2 in total)

- Final exam (40% of final grade)

3 Schedule

Schedule will be updated accordingly to what we cover in class on my webpage :

http://www.math.cmu.edu/~ldietric/21-241/

4 Policies

4.1 Attendance and participation

- Time will not allow me to check attendance in this class, however, it is expected that you will attend class regularly. If you do miss a class you are responsible to find out what was covered. If I see you missing regularly, I will ask for a reason. Conversely, do not hesitate to talk to me if you think you have reasons for missing.

- I strongly discourage you to use your laptop during classes, and if you do, I will ask you to sit on the back row so your screen does not distract anyone.

- Participation is strongly encouraged. I ask a lot of questions during classes and I will want to hear your thoughts. I might also ask someone to come at the blackboard and explain something to the class : it is a great exercise to learn and it's fun so do not hesitate to go for it !

4.2 Academic honesty and integrity

- Collaboration : I encourage you to collaborate and form study groups. Learning collaboratively opens your minds and forces you to clarify yours. Nonetheless it is clear that collaboration stops completely during the midterms and the final. Moreover, concerning the homework assignment, you should all write your solutions by yourselves. To avoid what I could consider as plagiarism, you should not write your assignment during collaborative sessions, but do that alone once your mind is clear.

- External resources : same thing here, I encourage you to use external resources (books, papers, internet...) but only to get your thoughts clear. If you copy something straight from some external resource, this is considered as plagiarism and constitutes cheating according to Carnegie Mellon's Policy on Cheating and Plagiarism.

  I plagiarise here David Handron's table which is a great summary of the above :

	you may...	you may not...
Homework	○ Consult with you instructor or your TA . ○ Use other textbooks or online resources to gain a better understanding of the materials. ○ Work together with your classmates to find solutions to problems.	○ Copy another students homework paper, or any portion thereof. ○ Copy a solution found in another textbook or web page. ○ Copy a solution from notes that are also copied by another student. ○ Use Solutions or graded homework from a previous semester's course in any manner.
Exams	○ Ask questions of any proctor (the proctor may or may not answer the question).	○ Ask any question of another student or answer questions asked of you. ○ Consult any unauthorized materials (books, notes, papers) or have these materials in a position where they may be consulted. ○ Attempt to view another student's exam or materials (authorized or unauthorized). ○ Listen to headphone devices.

4.3 Homework submission

Written assignments will be due on Fridays. You can give it to me just before the beginning or right after the end of the lecture, or put it in your TA's mailbox (WEH 6113) before 5pm (the mailbox office will close at that time). After that, homework will be considered late and will not be accepted.

4.4 Talk to me

I want you to enjoy this course ! So do not hesitate to talk to me and your TA for any reason. I encourage feedback, which you can provide by speaking to me or through e-mail. If you encounter some difficulties of any kind, I will be here to help you find a solution or to guide you, so again, do not hesitate, and the sooner the better.