

Math 340: Abstract Linear Algebra

Spring 2017

Lectures: MWF 9:30-10:20 in SIG 227

Instructor: Jarod Alper (jarod@uw.edu)

Office: PDL C-328

Office hours: Mon 1-2, Wed 11-12

Textbook: Friedberg, Insel and Spence: Linear algebra, 4th edition

- The textbook is on reserve in the Mathematics Library.
- While new versions of this textbook may be prohibitively expensive, there are various options to buy cheap used versions online.

Syllabus: The course is intended to be a second exposure to linear algebra. Topics will include vector spaces, bases, linear transformations, determinants, eigenvectors and eigenvalues, inner product spaces, orthogonal matrices, and singular value decomposition. The lectures will be rigorous introduction to these topics with an emphasis on proofs. However, there will also be a strong emphasis on applications.

Schedule: The content of the lectures will be posted here. The sections of the textbook quoted below are only a rough approximation of what we actually covered in class.

Lecture	Date	Topics covered	Remarks
Week 1			
1	Mon March 27	Introduction (Section 1.1)	
2	Wed March 29	Vector spaces (Section 1.2)	
3	Fri March 31	Subspaces (Section 1.3)	
Week 2			
4	Mon April 3	Linear combinations (Section 1.4)	
5	Wed April 5	Systems of equations and linear dependence (Sections 1.4-1.5)	HW 1 due
6	Fri April 7	Bases and dimension, Part I (Section 1.6)	
Week 3			
7	Mon April 10	Bases and dimension, Part II (Section 1.6)	
8	Wed April 12	Intro to linear transformations (Section 2.1)	HW 2 due
9	Fri April 14	More on linear transformations and quotient spaces (Section 2.1)	
Week 4			
10	Mon April 17	Matrix representations and composition (Section 2.2)	

11	Wed April 19	Composing linear transformations and matrix multiplication, and visualizing linear transformations (Section 2.3)	HW 3 due
12	Fri April 21	Isomorphisms and inverses (Section 2.4)	
Week 5			
13	Mon April 24	Midterm review	
14	Wed April 26	Midterm	
15	Fri April 28	Change of coordinates (Section 2.5)	
Week 6			
16	Mon May 1	First glance at determinants (Sections 4.1-4.4)	
17	Wed May 3	The determinant as a multilinear function (Sections 4.1-4.4)	HW 4 due
18	Fri May 5	Elementary matrices (Section 3.1) and properties of the determinant (Sections 4.1.4.4)	
Week 7			
19	Mon May 8	Even more about determinants (Sections 4.1-4.4)	
20	Wed May 10	Eigenvectors, eigenvalues and diagonalizable matrices (Section 5.1)	HW 5 due
21	Fri May 12	More on eigenvectors, eigenvalues and diagonalizable matrices (Section 5.1-5.2)	
Week 8			
22	Mon May 15	Characteristic polynomials and diagonalizable matrices (Section 5.2)	
23	Wed May 17	First glance at inner product spaces (Section 6.1)	HW 6 due
24	Fri May 19	More on inner product spaces (Sections 6.1-6.2)	
Week 9			
25	Mon May 22	Gram-Schmidt Orthogonalization Process (Section 6.2)	
26	Wed May 24	Orthogonal complements and adjoints (Sections 6.2-6.3)	
27	Fri May 26	Normal linear transformations (Section 6.4)	HW 7 due
Week 10			
	Mon May 29	No class! Memorial day	
28	Wed May 31	Spectral theorems and singular value decomposition (Sections 6.4, 6.6, 6.7) An application to image compression (see these notes by Paul Dostert)	
29	Fri June 2	Review	
Final			
	Wed June 7	Final examination, 8:30 - 10:20 am	

Homeworks: There will be weekly homework assignments. The lowest homework score will be dropped.

- Homework 1:
 - Section 1.2: Exercises 1 (you do not need to justify your answer), 8, 13, 20
 - Section 1.3: Exercises 1 (you do not need to justify your answer), 6, 8, 21
- Homework 2:
 - Section 1.4:
 - 2 (b,d) (solve both however you would like but justify your answer)
 - 7
 - Section 1.5:
 - 4
 - 13 (a,b) (here only consider the case where V is a vector space over F , the real numbers or complex numbers)
 - Section 1.6:
 - 3 (a,b,c,d,e) (Here $P_2(\mathbb{R})$ denotes the vector space of quadratic polynomials ax^2+bx+c where a,b,c are real numbers)
 - 8
 - 16
 - 28
- Homework 3:
 - Section 1.3: Exercise 31
 - Section 1.6: Exercise 35
 - Section 2.1: Exercises 4, 6, 11, 17, 28, 40 (a,b)
- Homework 4:
 - Section 2.2: Exercises 4, 16
 - Section 2.3: Exercises 3, 13
 - Section 2.4: Exercises 2(a,c,e) (justify your answer), 4
 - Section 2.5: Exercises 3(b,d), 10
- Homework 5:
 - Section 4.1: Exercises 5, 9
 - Section 4.2: Exercises 2, 4
 - Section 4.3: Exercises 13, 15
 - Section 4.4: Exercises 4(f,g), 6
- Homework 6:
 - Section 5.1: Exercises 3(d), 4(c,d), 9, 17
 - Section 5.2: Exercises 2(b,d), 3(a,b), 7, 11
- Homework 7:
 - Section 5.2: Exercises 20, 22
 - Section 6.1: Exercises 2, 5, 15
 - Section 6.2: Exercises 2(d,h), 9, 11
- Suggested additional exercises:
 - Section 6.3: Exercises 2(a,b), 3(a,b), 15
 - Section 6.4: Exercises 2(a,c,e), 4, 7(d)
 - Section 6.5: Exercise 2
 - Section 6.7: Exercises 2(a,b), 3(a,c)

Midterm: There will be one in class midterm

- Date: Wed April 26.
 - Time: 9:30-10:20 am (usual time)
 - Location: SIG 227 (usual location)
 - [Midterm solutions](#)
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Final examination:

- Date: Wed June 7
 - Time: 8:30-10:20 am
 - Location: SIG 227 (usual location)
 - [Sample exam problems](#)
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Grading:

- Homework: 30%
- Midterm: 30%
- Final: 40%

The lowest homework score will be dropped.