Linear Algebra

(CO16-100231)

Fall Semester 2018

Up-to-date course information can be found on the course website
http://math.jacobs-university.de/petrat/teaching/2018_fall_linear_algebra/

1 Official Course Description

This course continues the introduction to Linear Algebra from the course Elements of Linear Algebra from the Jacobs track "Methods Module". In the first part, we continue the discussion of endomorphisms, discussing minimal polynomials, the Cayley-Hamilton theorem, and the Jordan normal form. In particular, we study the application of the Jordan normal form to linear differential and difference equations. The second part of the course deals with dual spaces and quadratic, symmetric and skew-symmetric forms. We introduce the dual vector space and dual linear maps and their relation with bilinear forms. Classifications are given of symmetric and skew-symmetric real bilinear forms and of Hermitian and skew-Hermitian forms over the complex numbers.

2 Contact Information

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3 Time and Place

Mon 09:45 – 11:00, West Hall 4
Wed 08:15 – 09:30, West Hall 4

First class: September 5, 2018; last class: December 5, 2018
No classes on October 3 (German Unity Day), October 22 (reading day), and October 31 (Day of Reformation)

4 Textbooks

The class material is similar to the following textbook:

- A. I. Kostrikin and Y. I. Manin - Linear Algebra and Geometry (Gordon and Breach Science Publishers). This class covers parts of Chapters 1 and 2.

5 Exercises

Each week on Wednesday (with exceptions) there will be an exercise sheet/homework assignment. These are an integral part of the coursework and working on the exercise sheets consistently is the best preparation for the exams!

- The solutions have to be handed in at the beginning of class.
- No late submissions are accepted.
- The two worst exercise sheets are not considered for grading, in order to compensate for sickness, late adding etc.

- It is encouraged to discuss the exercise sheets with your classmates (e.g., discuss how to come up with the solution or what the right way of approaching the problem is). On the other hand, the solutions must be written down and handed in individually! Copying the solutions from somebody else is a violation of Academic Integrity.

6 Exams

There will be two exams, a midterm and a final. The midterm will cover all material from the first half of the course and the final will cover all material with emphasis on the second half. More details will be announced. Note that this class uses gradescope for grading exams, see https://gradescope.com for more information.

7 Grading

The final grade is weighted as follows:

Homework:	20%
Midterm:	30%
Final:	50%

Note: If the midterm grade is worse than the grade of the final, then only the grade of the final counts for both midterm and final.

8 Tentative Class Schedule

Session	Date	Topic
1	Sep 5	Vector Spaces
2	Sep 10	Subspace, span, basis
3	Sep 12	Basis and dimension
4	Sep 17	Linear Operators
5	Sep 19	Dual space, isomorphisms
6	Sep 24	Isomorphisms and basis
7	Sep 26	Dual Operators, dimensions of image and kernel
8	Oct 1	Sums, direct sums and dimensions
	Oct 3	**German Unity Day, no class**
9	Oct 8	Projections and quotient spaces
10	Oct 10	Fundamental spaces of a linear operator
11	Oct 15	Linear operators on finite dimensional spaces (diagonalization, eigenspaces)
12	Oct 17	Jordan decomposition, Cayley-Hamilton
	Oct 22	**Reading Day, no class**
13	Oct 24	**Midterm Exam**
14	Oct 29	Jordan basis
	Oct 31	**Day of Reformation, no class**
15	Nov 5	Systems of linear differential equations, decomplexification
16	Nov 7	Complexification, bilinear forms
17	Nov 12	Bilinear and sesquilinear forms
18	Nov 14	Classification of forms for small spaces
19	Nov 19	General classification of bilinear forms
20	Nov 21	Isotropic spaces
21	Nov 26	Inertia Theorem
22	Nov 28	Euclidean, Hermitian and symplectic spaces
23	Dec 3	Witt's theorem
24	Dec 5	Self-adjointness
	TBA	**Final Exam**