

# Algebra I (MATH 511)

Sabancı University, Fall 2022

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## Course content

**Groups:** definition and examples, homomorphisms, subgroups, normal subgroups, quotient groups, cyclic groups, symmetric group, group actions, Sylow subgroups, direct sums, free abelian groups, finitely generated abelian groups, free groups, solvable groups, finite simple groups.

**Rings:** definitions and examples, homomorphisms, ideals, commutative rings, factorization, polynomial rings, formal power series, groups rings, localization.

## Background and references

All theory will be build from scratch, and a basic (linear) algebra course and some prior experience with abstract mathematics should allow the student to follow the course. We will often follow Hungerford's Algebra book (reference [2]) but almost all material which will be treated in the course can be found in any graduate level algebra book, some example of which are listed below.

[1] Dummit, David S.; Foote, Richard M. Abstract algebra. Third edition. John Wiley & Sons, Inc., Hoboken, NJ, 2004. xii+932 pp. ISBN: 0-471-43334-9.

[2] Hungerford, Thomas W. Algebra. Reprint of the 1974 original. Graduate Texts in Mathematics, 73. Springer-Verlag, New York-Berlin, 1980. xxiii+502 pp. ISBN: 0-387-90518-9.

[3] Lang, Serge Algebra. Revised third edition. Graduate Texts in Mathematics, 211. Springer-Verlag, New York, 2002. xvi+914 pp. ISBN: 0-387-95385-X

## Objectives

This is the first part of the two-semester basic algebra course for graduate students. The aim is to strengthen students' familiarity with basic algebraic structures which are commonly used in all parts of mathematics. These structures include groups, rings, vector spaces, modules and fields.

## Performance assessment

- Students are expected to attend all lectures. If for some reason this is not possible, then the lecturer should be informed before the start of the lecture.
- The homework exercises will be published on SUCourse on a regular basis, and should be returned to the lecturer by email on the last day before the next lecture.
- Homework solutions and attendance will contribute (20%) towards the final grade.
- There will be one midterm (30%) and one final exam (50 %). Both exams consist of a written and an oral part. Further details will be announced in the lectures and on SUCourse.