

Representation Theory of groups

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48 hours

Necessary background: Linear Algebra.

Exam: Written

In the first part of the course we will introduce the basic notions of representation theory of finite groups over an algebraically closed field: subrepresentations, irreducible representations, complete reducibility, characters, tensor products, induction. Then we will show to which extent one can generalize techniques and results to infinite but compact groups.

In the second part of the course we will analyze representation theory of a special class of infinite groups with an additional structure, namely reductive algebraic groups. Their representation theory can be explained in terms of the representation theory of their associated Lie algebra. For this reason, we will introduce Lie algebras, provide the classification of simple Lie algebras, and describe their finite-dimensional irreducible representations.

References

J. Humphreys, *Introduction to Lie algebras and representation theory*. Graduate Texts in Mathematics, 9. Springer-Verlag, New York-Berlin, 1978.

M. Isaacs, *Character theory of finite groups*. Pure and Applied Mathematics, No. 69. Academic Press, New York-London, 1976

J.P. Serre, *Complex semisimple Lie algebras*. Springer Monographs in Mathematics. Springer-Verlag, Berlin, 2001.

J.P. Serre, *Lie algebras and Lie groups*. 1964 lectures given at Harvard University. Lecture Notes in Mathematics, 1500. Springer-Verlag, Berlin, 2006.

J.P. Serre, *Linear representations of finite groups*. Graduate Texts in Mathematics, Vol. 42. Springer-Verlag, New York-Heidelberg, 1977.