

# Computational Group Theory

Groups are mathematical objects that capture the concept of symmetry, and therefore have rich applications in mathematics and other sciences. Computational Group Theory fuses fundamental research in group theory with algorithmic methods. There are four main tasks: the design, the analysis, the implementation and the application of algorithms for groups and related structures.

The design and analysis of algorithms requires detailed structural and representation-theoretic results about groups, and is accompanied by mathematical proofs of correctness and, in many cases, of computational complexity. Efficient implementations are essential for the practical applications of this discipline. Algorithms developed in Computational Group Theory are distributed via major computer algebra systems, which guarantees a broad dissemination among the scientific communities and provides a long-term boost to the impact of this research. Experiments with computer algebra systems are widely used for conjecture-forming and testing, and for proving theorems in group theory and other disciplines. Computational and theoretical advances therefore facilitate one another.

Computational Group Theory has several distinct branches. These include, for example, algorithms for permutation and matrix groups, algorithms for free groups and finitely presented groups, group classifications, and the application of methods to different areas of mathematics and natural sciences. A major aim of this Oberwolfach workshop is to bring together researchers from different areas of Computational Group Theory and its applications to facilitate interaction.

Computational Group Theory draws on both theoretical and experimental research. The theoretical areas include the design of algorithms, proofs of decidability and complexity analysis. The practical areas focus on implementations of algorithms and their application to relevant problems. Both of these areas benefit immensely from each other and Oberwolfach is one of the key venues where researchers from these different fields meet and exchange ideas.