

# An Introduction to Computational Graph Theory and Generation Algorithms

*by Jan Goedgebeur*

Computers are often used in combinatorics to determine if combinatorial objects with given structural or extremal properties exist as these existence problems are often too complex to solve by hand. This is done by designing and implementing generation algorithms which construct combinatorial objects from a given class (typically avoiding the generation of isomorphic copies) and analysing the resulting objects.

In this talk we will give an introduction to computational graph theory and the design of generation algorithms in particular. We will also give concrete examples of how these generation algorithms have helped to gain new insights and solve problems in mathematics and in chemistry.

We will also present the House of Graphs (<https://houseofgraphs.org/>), which can be a useful tool when studying graphs. The House of Graphs hosts complete lists of graphs of various graph classes, but its main feature is a searchable database of so called "interesting" graphs, which includes graphs that already occurred as extremal graphs or as counterexamples to conjectures. We will highlight the features of the website and demonstrate how users can perform queries on this database and how they can add new interesting graphs to it.