

Decision Problems in Semigroups

Decision problems for automaton semigroups

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The theory of automaton groups – groups generated by the action of invertible Mealy machines – started in the 1980s as a way of constructing groups with exotic properties, such as Grigorchuk’s group of intermediate growth and other infinite torsion groups. Since then, a substantial theory has developed, including results showing that natural classes of groups arise as automaton groups. The concept of an automaton group generalizes naturally to semigroups by eliminating the requirement that the Mealy machine must be invertible. Automaton semigroups emerged as an independent field of study around fifteen years ago and this area has remained actively-studied.

It is natural to consider decision problems for automaton groups and semigroups. For instance, it is fundamental that all automaton semigroups have solvable word problems. It is known that the finiteness problem is undecidable for automaton semigroups and that the problem of deciding if an element has finite order is undecidable for automaton groups. This talk will discuss recent work on the decidability and complexity of decision problems for automaton (semi)groups, which includes a result that provides a better understanding of the connection between the finiteness of orbits of the action of the automaton and the finiteness of the semigroup.