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Generation and Analysis of Finite Monoids with an Emphasis on Syntactic Monoids

Abstract

The goal of this thesis is to generate and archive syntactic monoids of small order, also focusing on their algebraic properties. The analysis of the resultant database will shed some light on these monoids combinatorial or otherwise.

The code for this thesis allows us to generate syntactic monoids from a regular state graph with 2 to 5 states. The syntactic monoid is represented in the form of multiplication table. The code will also be able to identify properties such as left zero, right zero, commutative, dead state and immortal state. The code also identifies the cyclic groups around an idempotent and classifies them as trivial subgroups or non-trivial subgroups.

Two earlier computer science theses attempted to categorize finite groups of 64 elements or less as a web tool. Other thesis explored counter free automata, which can be algebraically described in terms of properties of syntactic monoids. The group theory approach is to try to characterize small order groups in terms of their algebraic properties, each as the orders of the group elements.

The motivation for this thesis is not just pure algebra of finite monoids, but rather the relevance of finite monoids to counter free automata, in particular to syntactic monoid with trivial and non-trivial subgroups.

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