Theoretical Computerscience – Summary

WS 24/25

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1 Words

A word w (also called String) has length l and consists of symbols $\sigma \in \Sigma$.
The empty word ε has length 0.

2 Regular Languages

3 Regular Expressions

A regular expression always describes a regular language. If we can build a regular expression E, then L(E) ∈ REG.

4 Common Proof Techniques

4.1 Pumping Lemma

4.1.1 Example

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4.2.1 Example

5 Useful Proofs

5.1 Regular Languages

5.1.1 Finite Set

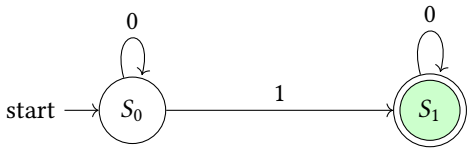
Exercise:
Show that the following language is regular over the alphabet {0,1}.
$L = \{x \mid x \text{ is prime and } x < 1'000'000'000\}$

Solution:
Since there are only finitely many prime numbers between 0 and 1′000′000′000, the set of the words that are accepted by L is finite and thus the language is regular.

5.1.2 Finite Automaton

Exercise:
Show that the following language is regular over the alphabet {0,1}.
$L = \{0^n 10^m \mid n,m \in \mathbb{N}\}$

Solution:



Since we can describe the language L by the finite automaton given above, the language is regular.

5.1.3 Regular Expression

5.2 Non-Regular Languages

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