

Guide to Exam 1

Time and Place

Exam 1 will be held in class on Friday, October 6, 2006. The exam is open book: You may use your notes, homeworks, any handouts and solutions provided to you in this class, the textbook (Sipser), and any other paper-based references.

General Things to Know

- Strings
- Languages: union, intersection, complement, concatenation, star
- Finite automata: DFAs, NFAs (both formal descriptions and state transition diagrams)
- Nondeterminism: computation trees
- Regular languages
- Closure properties of regular languages: closed under union, intersection, complement, concatenation, star, reverse
- Regular expressions
- Equivalence of DFAs, NFAs, regular expressions, regular languages
- Pumping Lemma

Specific Things You Should Know How to Do

- Given a formal description of a simple DFA or NFA, construct the corresponding state transition diagram, and vice-versa
- Given a simple DFA or NFA, be able to identify what language it recognizes
- Given a simple regular expression, be able to identify what language it describes
- Given a description of a simple regular language, be able to construct:
 - a DFA or NFA that recognizes it
 - a regular expression that describes it
- Given DFAs, be able to construct a DFA for their union, intersection, and complement
- Given NFAs, be able to construct an NFA for their union, concatenation, and star
- Understand the main steps in the proof of Kleene's Theorem (the equivalence of regular expressions, NFAs, and DFAs) and be able to carry out these constructions in simple examples:
 - Given an NFA, construct an equivalent DFA
 - Given a DFA, convert it to an equivalent regular expression
 - Given a regular expression, construct an equivalent NFA
- Be able to apply the Pumping Lemma for regular languages to prove a language is non-regular
- Be able to apply the closure properties of regular languages to prove a language is or is not regular

In addition you should understand the basic idea behind the proof of the Pumping Lemma for regular languages: when a DFA processes a sufficiently long string, the computation path it follows must have a loop.