

## Study Sheet for Exam 1

This exam will cover:

- From the Sipser's textbook, Chapter 0, parts of Chapter 1 (Sections 1.1, 1.2, 1.3), and Chapter 4.2 about countability/uncountability and diagonalization.
- Anything we have seen upto Tuesday 2016-09-27.

In particular, you have to be prepared to:

- Use mathematical notations and notions such as encountered in sets, relations, functions, ordering, etc.
- Use proof techniques like proof by contradiction, proof by induction, diagonalization principle, for solving problems.
- Show that a given set of definitions leads to a paradox (in the spirit of Russell's paradox, Cantor's uncountability).
- Show that a given set is countable or uncountable.
- Solve and prove any problem we have seen in class/recitation/hw/progamming-assignment.
- Give the formal defition of a regexp.
- Provide a regular expression recognizing a given language.
- Algorithm for matching string with regexp.
- Give a formal definition of an automaton ( $\epsilon$ -NFA, NFA, DFA).
- Show the run of an automaton for an input word.
- Give the formal definition of configuration, yield in one step, yield in several steps, language recognized by an automaton.
- Provide a language recognizing a given automaton.
- Define the algorithm converting regexps into NFAs, graphically and formally. Prove its correction. Execute it manually.
- Define the algorithm converting  $\epsilon$ -NFAs to DFAs. Prove its correction. Execute it manually.
- Define the algorithm converting GNFA's to regexps. Prove its correction. Execute it manually.
- Show that regular languages are closed under a given operation (like union, concatenation, Kleene's star, complement, intersection).
- Use any covered material to solve a new problem.