CS 584, Spring 2017
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Problem set 0 - Do not turn in

Read the Sipser textbook up to page 130 on your own. We will not cover this material in this version of the course, but you are required to be familiar with it since future homework/lecture/exams might use notions and problems related to DFAs/NFAs/regular expressions and PDAs/CFGs.

Pay special attention to:

1. definitions of DFA/NFA and PDAs/CFGs; definition of non-deterministic computation
2. language operations (union, intersection, complement, difference) and closure properties of finite automata/regular expressions/PDAs under language operations
3. equivalence of DFA/NFA/regular expressions and of PDAs/CFGs.
4. regular pumping lemma
5. PDA pumping lemma
6. the examples proved in the book

Solve the following problems (do not turn in)

1. Show that regular languages are closed under intersection, complement and set difference.
2. (Closure under reverse and sum) Book 1.31, 1.32.
3. (Closure under drop-out) Book 1.43
4. (Non-closure for CFL) Book 2.2
5. Let $\Sigma = \{(,)\}$ and let L be the language of properly nested parentheses (for example L contains strings ϵ,"()", "(()())((()))", but no ")(", "())".)
   (a) Give a CFG that generates L
   (b) Show that L is not a regular language
6. (CFL language) Book 2.24
7. Let $L = \{a^i b^j c^i | i \leq j \leq 2i\}$. Show that L is not a context-free language.
8. Book 1.37