

CSE422 Theory of Computation

HOMEWORK I

Due April 12, 2025 23:59

1. Prove that the class of regular languages is closed under intersection.
 2. (a) Define (formally) and draw a two state finite automaton that accepts the regular expression given by $(a \cup bc^*d)^*bc^*$.
(b) Convert $(0 \cup 1)^*1(0 \cup 1)$ to an NFA.
 3. Let M be a nondeterministic finite automaton for the set of all binary strings that have either the number of 0's odd, or the number of 1's not a multiple of 3, or both.
 - (a) Define M formally with a clear definitions of the 5-tuple. And define the language $A = L(M)$ as described above.
 - (b) Draw the state diagram of M .
 - (c) Is A the only language M recognise?
 - (d) Give an example string from A and show M accepts that string.
 - (e) Is that possible to describe this language in terms of regular expressions? If so, give the expression. If not, prove.
 4. Prove or disprove that $L = \{ww|w \in \{0,1\}^*\}$ is a regular language?
 5. (a) Define a CFG for the regular language corresponding to the regular expression 00^*11^* .
(b) Define a CFG for the regular language corresponding to the complement of the regular expression 00^*11^* (it will accept the string not generated by the given regular expression).
 6. Consider a nondeterministic pushdown automaton that has a single stack and that can move its input head in both directions on the input tape. In addition we assume that this PDA is capable of detecting when its input head is at either end of its input tape. This PDA accepts its input by entering an accept state.
Show that this PDA can recognise the language $\{a^ib^ic^i|i \geq 0\}$
- NOTE1: Upload your HANDWRITTEN answers to the Teams course page.

NOTE2: (No need to return these) Practice problems from the textbook:
Intro to the theory of computation by M. Sipser (2nd edition)

- (a) 1.4 part f.
- (b) 1.21 parts a and b.
- (c) 1.46 part d
- (d) 1.54
- (e) 1.55 parts c,h,j.
- (f) 2.4 part e.