

Test Examination Automata, Language Theory and Complexity (2ITS90)

January 6, 2021

This examination consists of 8 problems each having the same weight.

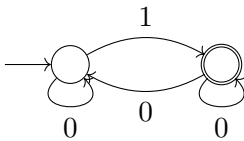
Problem 1.

Give a DFA accepting the language described by the regular expression

$$1(0+1)^*1.$$

Problem 2.

Give a DFA accepting the same language as the following NFA:



Problem 3.

Prove that the language

$$\{0^n 10^m \mid n \geq m \geq 0\}$$

is not regular.

Problem 4.

Give a context-free grammar for the language

$$\{0^n 10^m \mid n \geq m \geq 0\}.$$

Problem 5.

Give a PDA that accepts by empty stack the language of the following grammar:

$$S \rightarrow 0SA1|\epsilon$$

$$A \rightarrow 00|11.$$

Problem 6.

Let L be a context-free language. Prove that

$$\{u \in L \mid u \text{ has even length}\}$$

is context-free too.

Problem 7.

Give a Turing machine M such that

$$qw \vdash_M^* rwa$$

for every string w over the alphabet not containing blank symbols, for two particular states q, r .

Problem 8.

Establish whether the formula

$$(x \vee y) \wedge (w \vee z) \wedge \neg x \wedge (\neg y \vee \neg w)$$

is satisfiable. If so, give a corresponding truth assignment.