

Homework 3
Due 2016-10-28

(3pt) Problem 1

With Σ_3 as defined in Problem 1.32 page 88. Prove that the following language is not regular

$$A = \{w \in \Sigma_3^* \mid \text{the bottom row of } w \text{ is the product of the top two rows}\}$$

(4pt) Problem 2

Provide an implementation-level description of a 3-tape Turing machine performing the binary addition of two numbers. Assume the Turing machine finds at the beginning of the computation, on its first tape the string $n1\#n2$ where $n1$ and $n2$ are the strings for the two input numbers. At the end of the computation the first tape should contain only the result for the addition. The second and third tapes can be used as you wish.

To answer this question you will need to provide a notation to describe an operation of a 3-tape Turing machine. In comparison with single-tape Turing machine, the notation is $a \rightarrow b, L$ is only for a transition on one tape. In the case of a 3-tape Turing machines, a single transition should be made of 3 such single-tape transition. A well designed notation might facilitate the implementation-level description of your 3-tape Turing machine.

In addition to the implementation-level description, explain in plain text how the 3-tape Turing machine works.

(3pt) Problem 3

Problem 3.12, page 189. Solve it the same way we solved similar problems in class and provide all the details.