

## Exercise 1

**Task 1.** Let  $f$  be an increasing function. Are the following statements correct? Give reasons for your answer.

1. Every  $f$ -time-bounded Turing machine is  $f$ -space-bounded.
2. Every  $f$ -space-bounded Turing machine is  $f$ -time-bounded.

**Task 2.** Let  $M$  be a deterministic finite automaton that accepts the formal language  $L(M)$ . Find a Turing machine that also accepts  $L(M)$ . Is this Turing machine  $f$ -space-bounded in terms of a function  $f$ ?

**Task 3.** Give a formal definition of the relation symbol  $\vdash$  (slide 6 of the lecture).

**Task 4.** Let  $f : \mathbb{N} \rightarrow \mathbb{N}$  be a monotone growing function

1. Show that  $\text{DTIME}(f)$  is closed under union and intersection.
2. Is it true or not that  $\text{DTIME}(f(n)) \subset \text{DSPACE}(f(n))$ ? Give reasons for your answer.