

## Exercises for Computability and Complexity, Spring 2019, Sheet 1

*As in the FLL course, you may work in miniteams of two (but not more).*

*Please return on Tuesday Feb 12 in class.*

**Exercise 1** Give a transition table for a TM that computes the function  $f(n) = 2n$ . The TM should have the tape alphabet  $\{0, 1, \triangleright, \sqcup\}$  and numbers are coded as binary strings by writing them to base 2.

**Exercise 2** If one would admit TMs with countably many states, would this extend the set of TM-computable functions on the integers? In other words, is there a function  $f: \mathbb{N} \rightarrow \mathbb{N}$  which can be computed by some TM with countably infinitely many states, but not by any ordinary TM? Sketch a proof for your answer.