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 $f: \mathbb{N} \to \mathbb{N}$ which can be computed by some TM with countably infinitely many states, but not by any ordinary TM? Sketch a proof for your answer.