

Exercises for Computability and Complexity, Spring 2017, Sheet 1

Please return your solutions in class, in the Thursday lecture on Feb 9.

Note: You may work in teams up to size 2.

Exercise 1 Show that a TM whose read/write head are restricted to the left and right moves $\{\leftarrow, \rightarrow\}$, can compute the same functions as the TMs from the definition in the lecture notes whose heads can pick motions from the set $\{\leftarrow, \rightarrow, -\}$.

Exercise 2 Give a formal definition of a version of TMs that use a 2-dimensional grid of memory cells instead of a 1-dimensional tape. Start with a plain English description of your basic ideas and intuitions of how to make a 2-dim grid useful for computations in the TM spirit, that is, what special grid cell symbols you want to use, how to initialize the grid, how to administer input. Then repeat-adapt definition 3.1 in formal rigor, and also give a formal definition of a configuration. Note: there are many ways how a 2-dim TM can be set up in a reasonable way, so there is not a singular "correct" definition.

Exercise 3 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.