

## Exercises for Computability and Complexity, Spring 2019, Sheet 9

*Please return your solutions in the Tuesday lecture on April 23*

This exercise sheet revolves around the problem PARTITION. This is a standard NP problem which is defined as follows:

The instances of PARTITION consist in a finite nonempty set  $A$  and a function  $s: A \rightarrow \mathbb{N}$  (the intuition is that  $s$  assigns to each element  $a \in A$  a "size"  $s(a)$ ). The question is: can  $A$  be split into two disjoint subsets  $A = B \cup C$ , such that the total sizes of  $B$  and  $C$  are the same, that is  $\sum_{b \in B} s(b) = \sum_{c \in C} s(c)$ ?

**Exercise 1** Describe a coding scheme by which instances of PARTITION can be represented as input words to a TM, using the coding alphabet  $\{0, 1, \#\}$ .

**Exercise 2** Show that PARTITION is in NP (use the input coding that you proposed in Exercise 1). Be reasonably precise in describing your solution, to the level that you describe what intermediate results a TM will write on which of its tapes.