

Homework 3 Practice Problems

Below is a set of practice problems on Turing machines, to help you check your understanding of the material we've discussed in class. We're willing to listen to you describe your solutions or to look at your writeups during office hours. If you want even more practice problems, those problems and exercises marked "A" in the textbook have answers at the end of the chapter.

Note: If you want to discuss these problems, I expect you to give correctness proofs here, just as on the actual homework.

Practice Problems

1. Let $L = \{0^p \mid p \text{ is prime}\}$. Construct a Turing machine that decides L . Your TM may be multitape but should otherwise be defined using only basic moves and seeking, marking, and remembering operations. Describe your construction in pseudocode (the same way I did the machine for ww) and explain in words how it works.
2. (a) If L_1 and L_2 are RE languages, prove that their concatenation $L_1 \cdot L_2$ is also RE.
(b) If L is an RE language, prove that L^* is also RE.
3. Show that the following languages are not recursive.
 - (a) $EVEN = \{x \mid x = e(M), M \text{ is a TM, } M \text{ accepts } \varepsilon \text{ in an even \# of moves}\}$
 - (b) $FOREVER = \{x \mid x = e(M), M \text{ is a TM, } M \text{ runs forever on some input}\}$