

Name: YOUR NAME HERE

CS46 Homework 7

This homework is due at 11:59pm on **Tuesday, March 17**. This is an 8-point homework.

You may work with one partner on this lab. Your write-up is your own: do not share it, and do not read other teams' write-ups. If you use any out-of-class references (anything except class notes, the textbook, or asking the instructor), then you **must** cite these in your post-lab survey. Please refer to the course webpage or ask me any questions you have about this policy.

Your solution to this lab should be written using \LaTeX and submitted using **github** as a **.tex** file. Write clear and unambiguous implementation-level Turing machine descriptions. Your explanation of *why* and *how* a Turing machine works should be separate from your description of that Turing machine. Give the Turing machine description first, then explain it separately.

The main **learning goal** of this homework is to work with and think about Turing machines.

1. **Another Turing machine extension.** Let's consider an extension which gives a Turing machine tape which is infinite in both directions. We keep everything else the same, and specify that the input string is given on a tape which is blank everywhere else, with the read/write head on the first character of the input. So the starting configuration on input w in state q_0 looks like:

$$\dots \square \square q_0 w \square \square \dots$$

Notice that now the tape head can *always* move left, no matter where it is.

Prove that Turing machines with doubly infinite tape are no more powerful than standard Turing machines (that is, with singly-infinite tape).

2. Show via a constructive proof that if a language L is recognizable by a Turing machine M and the complement of L , denoted \bar{L} , is also recognizable by a Turing machine \bar{M} , then L is decidable.