Name: YOUR NAME HERE

CS46 Homework 9

This homework is due at 11:59pm on Tuesday, March 31. This is a 6-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.

The main **learning goal** of this homework is to work with and think about Turing machines and decidability. You should feel free as always to cite and use techniques and theorems from class or the textbook.

1. A **useless state** in a Turing machine is one that is never entered on any input string. Consider the problem of determining whether a Turing machine has any useless states.

   (a) Formulate this problem as a language.

   (b) Show that this language is undecidable.

2. Prove that the following language is undecidable:

$$REV_{TM} = \{\langle M \rangle \mid M \text{ is a TM and } \forall w, \text{ if } w \in L(M) \text{ then } w^R \in L(M)\}$$

   Consider a reduction from A_{TM} to REV_{TM}.