CSE 3321 - Problem Set 7
Due beginning of lecture on November 19th

Problem numbers are from the third edition of Sipser’s book. If unsure about which problem to solve, ask. Collaboration is permitted; looking for solutions from external sources (books, the web, material from previous years, etc.) is prohibited.

1. Consider the problem of determining whether a Turing machine \( M \) on an input \( w \) ever attempts to move its head left at any point during its computation on \( w \). Formulate this problem as a language and show that it is decidable.

2. Consider the problem of determining whether a Turing machine \( M \) on an input \( w \) ever attempts to move its head left when its head is on the left-most tape cell. Formulate this problem as a language and show that it is undecidable.

3. Let \( T = \{ \langle M \rangle : M \text{ is a T.M. that accepts } w \text{ reversed whenever it accepts } w. \} \). Determine whether \( T \) is decidable, undecidable but recognizable or unrecognizable. Prove your answer.

4. Show that \( A \) is Turing-recognizable iff \( A \leq_m A_{TM} \).