Reminder: If you haven’t already done so, subscribe to the CSE 431 mailing list ASAP by following the link off the course webpage: http://www.cs.washington.edu/431/.

Reading assignment: Chapter 3 of Sipser.

Instructions: Information on the collaboration policy and honor code in solving problem sets can be found on the course web page. Please read it carefully.

This problem set has four problems. Each question is worth 10 points. Please be as careful as possible in your arguments and your answers.

1. Give an implementation level description of a Turing machine (i.e. use English prose to describe the way the Turing machine moves its head and the way it stores data on the tape) that decides membership in the language

   \[ L = \{ w \in \{0,1\}^* \mid w \text{ contains an equal numbers of 0s and 1s} \}. \]

2. Problem 3.11 in Sipser’s book. (A Turing machine with doubly infinite tape is equivalent in power to a standard Turing machine.) Give a formal description (tape alphabet, transition function, etc.) of your Turing machine that simulates the functionality of a TM with a two-way tape.

3. Problem 3.13 in Sipser’s book. (Turing machines with “stay put” instead of left.)

4. Show that a language is decidable if and only if some enumerator enumerates the language in lexicographic order.