CSE 431: Theory of Computation (Spring 2008) **Instructor: James R. Lee**
Problem Set #1 **Due: Thursday, Apr 10**

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.

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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.