CS152 **SPRING 1999**

Homework 2

Due: Friday, Feb. 26, at 9:00pm in the handin bin located on 2^{nd} floor CIT

Collaboration is allowed only by terms of the policy. All problems are worth 20 points. TA hours: Jason Friday 3-4PM, Tom Thursday 8-9PM in the TA annex room on the second floor of the CIT.

Problem 1.

Give implementation-level descriptions of Turing machines that decide the following languages over the alphabet $\{0, 1\}$:

a. $\{w|w$ contains twice as many 0s as 1s$\}$.

b. $\{w|w$ does not contain twice as many 0s as 1s$\}$.

Problem 2.

A *Turing machine with stay put instead of left* is similar to a n ordinary except that the transition function has the form

$$\delta : Q \times \Gamma \longrightarrow Q \times \Gamma \times \{R, S\}.$$

At each point the machine can move its head right or let it stay in the same position. Show that this Turing machine variant is *not* equivalent to the usual version. What class of languages do these machines recognize?

Problem 3.

Show that a language is decidable iff some enumerator enumerates the language in lexicographic order.

Problem 4.

Show that single-tape TMs that cannot write on the portion of the tape containing the input string can only recognize regular languages.

Problem 5.

Let A be the language containing only the single string s, where

$$s = \begin{cases} 0 & \text{if the universe will not expand forever} \\ 1 & \text{if the universe will expand forever.} \end{cases}$$

Is A decidable? Why or why not?