CS154: Introduction to Automata and Complexity Theory **Fall 1997**

Assignment #4

Due: Wednesday, November 12th, 1997.

Problem 1 (2.5 point) Consider a restricted class of TM's in which the transition function is defined as $\delta : Q \times \Gamma \to Q \times \Gamma \times \{R\}$. That is, the tape head can only move right. What class of languages does this restricted class of TM's recognize? Give a rigorous proof for your answer.

Problem 2 (2.5 points) Formally describe a Turing Machine that recognizes the following language over $\Sigma = \{0, 1, \#\}$:

$$L = \left\{ \#x\#y \;\middle|\; \begin{array}{l} \text{where } x \text{ is the binary} \\ \text{representation of a positive integer } a \text{ and} \\ y \text{ is the binary representation of } a+1. \end{array} \right\}$$

Problem 3 (2.5 points) Prove that if both $L \subseteq \Sigma^*$ and $\bar{L} = \Sigma^* \setminus L$ are R.E. then L is recursive.

Problem 4 (2.5 points) Define a singleton-TM to be a two-tape TM where the finite control only has three states $Q = \{q_0, q_{acc}, q_{rej}\}$. Prove that every one-tape TM has an equivalent singleton-TM.