Due on 14 April 2009, start of class

Please submit a paper copy in class.

CSE 355 Homework Five

1. Sipser 3.4.
2. Sipser 3.7.
3. Consider the language $L = \{w | w$ contains exactly twice as many 0's as 1's $\}$ over the alphabet $\{0,1\}$. Give an implementation-level description and a low-level description of a Turing machine that decides $L$.

3.4 Give a formal definition of an enumerator. Consider it to be a type of two-tape Turing machine that uses its second tape as the printer. Include a definition of the enumerated language.

3.7 Explain why the following is not a description of a legitimate Turing machine.

$M_{had} = \text{"The input is a polynomial } p \text{ over variables } x_1, \ldots, x_k.$
1. Try all possible settings of $x_1, \ldots, x_k$ to integer values.
2. Evaluate $p$ on all of these settings.
3. If any of these settings evaluates to 0, accept; otherwise, reject."

3.13 A Turing machine with stay put instead of left is similar to an ordinary Turing machine, but the transition function has the form

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

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?

3.14 A queue automaton is like a push-down automaton except that the stack is replaced by a queue. A queue is a tape allowing symbols to be written only on the left-hand end and read only at the right-hand end. Each write operation (we'll call it a push) adds a symbol to the left-hand end of the queue and each read operation (we'll call it a pull) reads and removes a symbol at the right-hand end. As with a PDA, the input is placed on a separate read-only input tape, and the head on the input tape can move only from left to right. The input tape contains a cell with a blank symbol following the input, so that the end of the input can be detected. A queue automaton accepts its input by entering a special accept state at any time. Show that a language can be recognized by a deterministic queue automaton iff the language is Turing-recognizable.