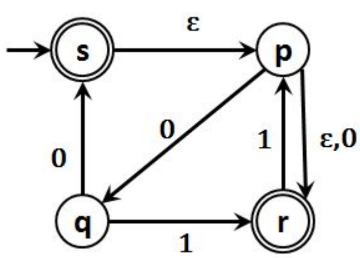
CSE 431 Spring 2012
Assignment #1

Due: Friday, April 6, 2012

Reading assignment: Read Chapter 3 of Sipser's text.

Problems:

1. Draw the state diagram of the DFA that is the result of converting the following NFA to a DFA using the subset construction. Only show the states that are reachable from the start state.



2. Sipser's text (1st or 2nd edition) Problem 3.7.

3. Give a Turing machine diagram for a Turing machine that on input a string $x \in \{0,1\}^*$ halts (accepts) with its head on the left end of the tape containing the string $x' \in \{0,1\}^*$ at the left end (and blank otherwise) where x' is the successor string of x in lexicographic order; i.e. the next string in the sequence $\epsilon, 0, 1, 00, 01, 10, 11, 000, \ldots$ in which the strings are listed in order of increasing length with ties broken by their corresponding integer value. (Briefly document your TM.)

4. Turing in his paper said that the 2-dimensional natural of the paper is not essential. In this question you will show why that is the case:
A Turing machine with a 2-dimensional tape is like a 1-tape TM except that it marked with an infinite 2-dimensional grid of cells that are all blank, except for the input which is given in the cells starting with the cell under the read/write head and continuing with the sequence of cells immediately to the right. Additional changes are that

   - the transition function δ, is $\delta : Q \times \Gamma \to Q \times \Gamma \times \{L, R, U, D\}$ where U and D indicate moves *up* and *down* one cell.
   - there is no end of the tape.

   Give an implementation level description of how an ordinary 1-dimensional Turing machine can simulate a 2-dimensional one; that is, the 1-dimensional TM should accept, reject, or run forever on exactly the same set of inputs as the 2-dimensional one does.