Homework 6 (graded): Due November 7, 2005

1. [20 points] Construct a Deterministic Finite Automaton (DFA) for each of the following languages:
   a) The set of all strings over \{a, b, c\} that end with \(bb\) and contain at least one \(a\). (For example, \(acbaabb\) and \(abb\) are in the language, but \(bbac\) and \(bb\) are not in the language.)
   b) The set of all strings over \{a, b, c\} that contain at least one \(a\) and one \(c\). (For example, \(abca\) is in the language, but \(ab\) is not in the language.)

2. [20 points] Construct a Nondeterministic Finite Automaton (NFA) for each of the following languages:
   a) The set of all strings over \{a, b, c\} that end in either \(bb\) or \(cc\). (For example, \(acbb\) and \(bcc\) are in the language, but \(bcc\) and \(bcbb\) are not in the language.)
   b) The set of all strings over \{a, b, c\} that contain \(ba\) or \(bca\) (or both) as substrings. (For example, \(cbba\) and \(bcaab\) are in the language, but \(bcca\) and \(ab\) are not in the language.)

3. [20 points] Use algorithm 11.8 (pp. 671-672) to construct a DFA that is equivalent to the NFA below. Clearly label each DFA state with the set of NFA states that it represents. The alphabet is \{a, b\}.

   ![DFA Diagram](image)

4. [20 points] Use algorithm 11.5 (p. 651) to construct a regular expression that is equivalent to the NFA in question 3. Show your work.

5. [20 points] Use algorithm 11.4 (pp. 648-649) to construct an NFA for the regular expression \(b(aa)^* + bb\) Show your work.