CS 1502 Exam III

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15 December 2005

Instructions: This is a closed book, note and neighbor exam! You must show all work in the space provided on this test.

Name: ___________________________

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Question 1 (25 points) Using the method given in the book construct a deterministic finite automaton which is equivalent to the following non-deterministic automaton:

Note that you need only provide the “reachable part” of the book’s construction.
Question 2 (25 points)

a) For each of the following languages construct a deterministic finite automaton (DFA) that recognizes it:

i) \( L_1 = \{ w \in \{a, b\}^* : w \text{ has an even number of } a’s \} \)

ii) \( L_2 = \{ w \in \{a, b\}^* : w \text{ ends in } ab \} \)

b) Using these two machines construct a DFA for the language

\[ L_3 = L_1 \cap L_2. \]
Question 3 (25 points) Using the method given in the book construct a regular expression over the alphabet \{a, b\} which describes the language recognized by the following finite state automaton:

Be sure to include complete details of your construction.
Question 4 (25 points)

a) State the Pumping Lemma for Regular Languages.
   [Be sure to include all required quantifiers and components of the statement.]

b) Consider the following language

   \[ L = \{ w \cdot w^R : w \in \{a, b\}^* \}, \]

   where \( w^R \) denotes the reverse of the string \( w \) (e.g., \( abb^R = bba \)). Prove that \( L \) is not regular by using the Pumping Lemma for Regular Languages.