CS 1502 Exam III

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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)

a) Construct the state-transition diagram for a deterministic finite state
automaton that recognizes the language \(a^{3n+1} : n \geq 0\) over the
alphabet \(\Sigma = \{a\}\).

[Be sure to include all transitions in your diagram.]

b) Give a brief description of how your finite state automaton works.

c) For each state of your finite state automaton give its “semantic content”
(i.e., its meaning).
Question 2 (25 points) Using the method given in the book construct the state-transition diagram for 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 3 (25 points) Using the construction given in the book construct a regular expression which describes the language recognized by following finite automaton:

[Be sure to include all transitions in your diagram.]
Question 4 (25 points)

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

b) Use the Pumping Lemma to show that the language \(\{0^n^3 : n \geq 0\}\) over the alphabet \(\Sigma = \{0\}\) is not regular.