CS311 – Computational Structures – HW3

Tuesday, October 9, 2012
due in class Tuesday, October 16, 2012

Answer each question below. Write your answers neatly on paper. Be sure your name is on the paper, and the paper is clearly identified as Homework 3.

1. Problem 6, Section 11.1, page 703 of the text. Prove equality of regular expressions. Justify steps using properties from 11.1, page 700 of the text (a 4 pts, b 4 pts, c 4 pts).

2. Problem 1, Section 11.2, page 726 of the text. Transition function DFA. (8 pts).

3. Problem 2, Section 11.2, page 726 of the text. Create DFA from Reg Exp. (a 3pts, b 3 pts, c 3 pts, d 3 pts, e 3 pts, f 4 pts).

4. Problem 3, Section 11.2, page 726 of the text. Word Problem, DFA for Rational constant. (10 pts).

5. Problem 4, Section 11.2, page 727 of the text. Transition function NFA. (8 pts).

6. Problem 6, Section 11.2, page 727 of the text. Use Algorithm 2 of the notes to transform RE -> NFA (b 5 pts, c 6 pts).

7. Prove by induction that for any natural number n, the sum of the first n natural numbers is equal to n(n + 1)/2. Do this on your own. Don't look it up anywhere (14 points).

   - What is the induction variable? (2 points)
   - What is the formula as a function of the induction variable. (2 points)
   - Use the formula to describe the structure of the proof. (2 points)
   - Carry out the steps of the proof, label each step. (4 points)
   - Write down any facts about arithmetic that you use in your proof. (4 points)

8. NFA to DFA. 9 points each.

   For each of the following (there are 2 problems, flip page for second one):

   (a) Please (1) draw the NFA described by the transition table [1 point], (2) use the power set construction to convert the NFA to a DFA (list all possible states and transitions of the DFA) [4 points], (3) label the start and final states [2 points], and (4) draw the reachable states of the resulting DFA [2 points].

	1 start	2	3 final
a	$\{1,2\}$	$\{2\}$	$\emptyset$
b	$\{1\}$	$\{2,3\}$	$\emptyset$

(b) Please (1) draw the NFA described by the transition table [1 point], (2) use the power set construction to convert the NFA to a DFA (you may list only the reachable states and their associated transitions of the DFA) [4 points], (3) label the start and final states [2 points], and (4) draw the reachable states of the resulting DFA [2 points].

	1 start	2	3	4 final
Λ	$\{2\}$	$\{3\}$	$\{4\}$	$\emptyset$
a	$\emptyset$	$\{2\}$	$\emptyset$	$\emptyset$
b	$\emptyset$	$\emptyset$	$\{3\}$	$\emptyset$