

CS581 – Theory of Computation – HW2

Tuesday, April 9, 2013
due in class Tuesday, April 16, 2013

Answer each question below. You will turn this homework in using D2L. In addition, you may also turn in a paper copy in class. In this case the TA will mark up your homework with comments and return the comments to you.

You may format your answers using some document processing software, or you may write it up with pencil and paper and scan it. In either case submit a pdf document. Be sure your submission is clearly identified as Homework 2, and contains your name and your email on the first line. The first line should look like:

CS581 HW #2

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1. Use the product construction to give an DFA which recognizes the intersection of the languages over the alphabet $\{a, b, c\}$
 - $\{w \mid w \text{ contains at most 2 a's}\}$
 - $\{w \mid w \text{ contains exactly 1 b, and 2 c's}\}$ Give only that part of the DFA that is reachable from the start state.
2. Do the following
 - Give an NFA recognizing the language $(01 \cup 001 \cup 010)^*$
 - Convert this NFA to an equivalent DFA. Give only the portion of the DFA that is reachable from the start state.
3. Use the construction given in proof of theorem 1.47 to give a state diagram for an NFA recognizing the concatenation of the two languages over the alphabet $\{0, 1\}$.
 - $\{w \mid \text{the length of } w \text{ is at most 5}\}$
 - $\{w \mid \text{every odd position of } w \text{ is a 1}\}$
4. Use the construction given in proof of theorem 1.49 to give a state diagram for an NFA recognizing the star of the language over the alphabet $\{0, 1\}$.
 - $\{w \mid \text{contains at least two 0's, and at most one 1}\}$

5. Let F be the language of all strings over $\{0, 1\}$ that do not contain a pair of 1's that are separated by an odd number of symbols. Give the state diagram of the DFA with 5 states that recognizes F . Hint - You may find it helpful to construct a 4-state NFA for the complement of F .
6. Let $C_n = \{x \mid x \text{ is a binary number that is a multiple of } n\}$. Show that for each $n \geq 1$ the language C_n is regular (recognized by some DFA). You have a choice of reading the 0's and 1's of the binary number from the left or right. Clearly state what order you read them.