Assignment 1 – CS 301 - Theory of Automata – Spring 2019

Total Marks: 110 Due: September 12, 2018 (in class)

Note: Late submissions will have 25% deduction.

1. [6*5] Give DFA for the following languages, over the alphabet {0,1}
   a) All strings that contain three consecutive 1's
   http://theory.stanford.edu/~rajeev/CS154/solution1.pdf
   b) All strings that do not end with 00
   http://theory.stanford.edu/~rajeev/CS154/solution1.pdf
   c) All strings with even number of 0's and odd number of 1's
   d) All strings with even number of 0's and exactly 2 1's
   https://courses.engr.illinois.edu/cs373/sp2010/problem_sets/hw_01_sol.pdf
   e) All strings that are at least of length 4 and contains even number of 1's
   http://suraj.lums.edu.pk/~cs311w05/hw/hw02Sol-updated.pdf
   f) All strings such that every 00 is followed by a 1.
   http://suraj.lums.edu.pk/~cs311w02/Quizes/CS311quiz1s1.pdf
   g) All strings such that each '0' is immediately preceded and followed by a '1'
   https://www.cs.utexas.edu/users/cline/ear/automata/CS341-Fall-2004-Packet/2-Homework.pdf
   h) All strings have 0101 as a substring
   https://www.cs.utexas.edu/users/cline/ear/automata/CS341-Fall-2004-Packet/2-Homework.pdf

   The language of all strings containing no more than one occurrence of the string aa. (the string aaa should be viewed as containing 2 occurrences of aa)
   (Ms Noshaba notes)

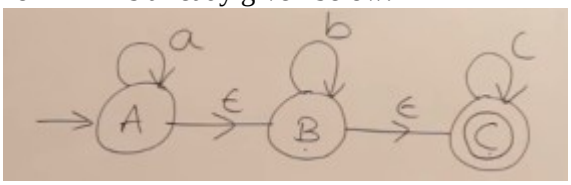
2. [10+10]
   a) Draw a DFA over $\Sigma = \{0, 1\}$ that accepts the set of all strings that, when interpreted in reverse as a binary number, is divisible by 3. Examples: 011 (110 = 6), 0, 0011 (1100 = 12), 01001 (10010 = 18), etc.
   https://courses.engr.illinois.edu/cs373/sp2010/problem_sets/hw_01_sol.pdf
   b) Find DFA for the following language on $\Sigma = \{a, b\}$. (Try and do this in as few states as possible) $L=\{w: (n_a(w)- n_b(w)) \bmod 3 > 0\}$
   http://suraj.lums.edu.pk/~cs311w02/Assignments/cs311Assignment1_Solution.pdf

3. [25] Consider the following two languages over the alphabet {0, 1}.
   L1 = {w | w contains odd number of 0s}
   L2 = {w | w neither contains two consecutive 0s nor two consecutive 1s}
   Construct DFA's for both the languages and then find another DFA using these two DFAs, which represent L1 - L2

4. [20] Draw and convert the following epsilon-NFA (or lambda-NFA) to corresponding DFA
   $L = \{a^n \mid n \text{ is even or divisible by } 3\}$

   http://web.cecs.pdx.edu/~sheard/course/CS311/Fall2013/ppt/NfaEpsilonDefined.pdf

Epsilon-NFA is already given below:



https://www.youtube.com/watch?v=FYk8EpDR3XM&list=PLEbnTDJUr_IdM___FmDFBJBz0zCsOFxfK&index=585.