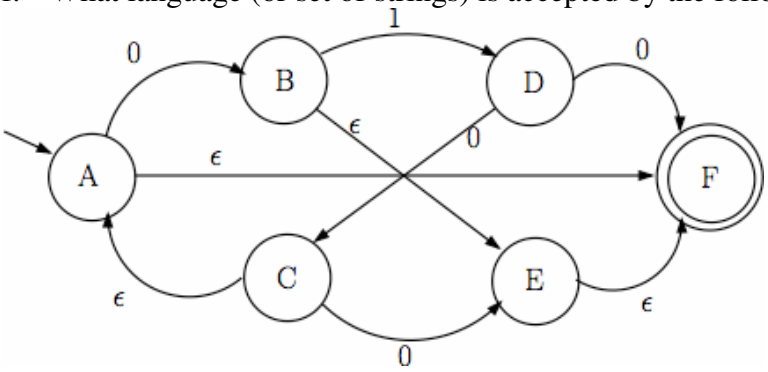
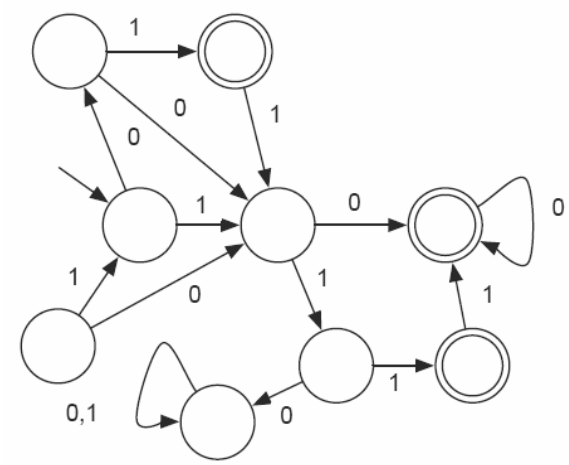
CMSC 330, Practice Problems 2

1. Regular expressions and languages
    a. From the perspective of formal language theory, what is a language?
    b. Given the language A = {“aa”, ”c”} and B = {“b”}, what is the language AB?
    c. Given the language A = {“aa”, ”c”}, what is the language A^0?
    d. Given the language A = {“aa”, ”c”}, what is the language A^2?
    e. Given the language A = {“aa”, ”c”}, what is the language A*?
    f. Give a regular expression for all binary numbers including the substring “101”.
    g. Give a regular expression for all binary numbers with an even number of 1’s.
    h. Give a regular expression for all binary numbers that don’t include “000”.

2. Finite automata
    a. When does a NFA accept a string?
    b. How long could it take to reduce a NFA with n states and t transitions to a DFA?
    c. Give a NFA that only accepts binary numbers including the substring “101”.
    d. Give a NFA that only accepts binary numbers that include either “00” or “11”.
    e. Give a NFA that only accepts binary numbers that include both “00” and “11”.
    f. What language (or set of strings) is accepted by the following NFA?



    g. Compute the ε-closure of the start state for each of the NFA above.
    h. Give a DFA that only accepts binary number with an odd number of 1’s.
    i. Give a DFA that only accepts binary numbers that include “000”.
    j. Give a DFA that only accepts binary numbers that don’t include “000”.
    k. What language (or set of strings) is accepted by the following DFA?



l. For each regular expression: 1*, (0|01)*0
   i. Reduce the RE to an NFA using the algorithm described in class.
   ii. Reduce the resulting NFA to an DFA using the subset algorithm.
   iii. Show whether the DFA accepts / rejects the strings “1”, “11”, “101”
   iv. Minimize the resulting DFA using Hopcroft reduction
   v. Are any 2 of the minimized DFA identical?