CS341 Automata Theory (Summer 2008)
Homework Assignment ♯2
Due Date: June 13, 2008 (At the beginning of class)

Do not forget to write your name and EID.

1. Construct DFAs for the following languages.

   (a) The set of all binary strings having a substring 00 and ending with 01.

   (b) The set of all binary strings having a substring 00 but not ending with 01.

   (c) The set of all binary strings with 3 consecutive zeros.

   (d) The set of all binary strings beginning with a 1 which, interpreted as the binary representation of an integer, is congruent to 0 modulo 5.

   (e) The set of all strings over alphabet $\{a, b\}$ of length up to 3.

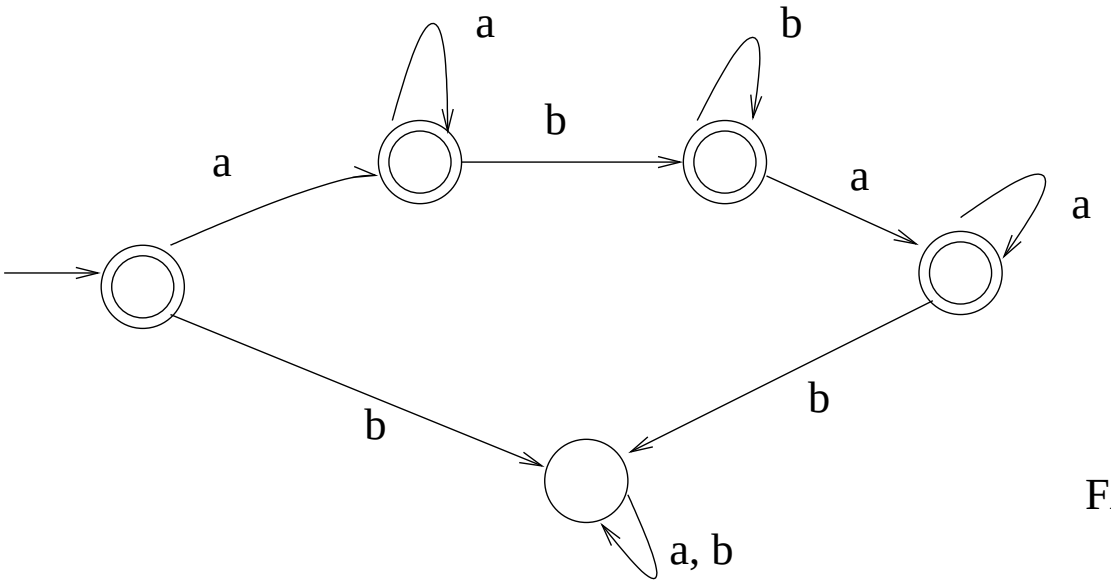
   (f) The set of all strings of length $3n, n = 0, 1, 2, ...$

2. Construct NFAs for the following languages.

   (a) $\{a^n b a^m | \ n, m \geq 0, \ n \equiv_5 m\}$.

   (b) The set of all strings of 0's and 1's such that 10th symbol from the right end is a 1.

3. (a) Describe informally the language accepted by the finite automaton.



FA for #3a

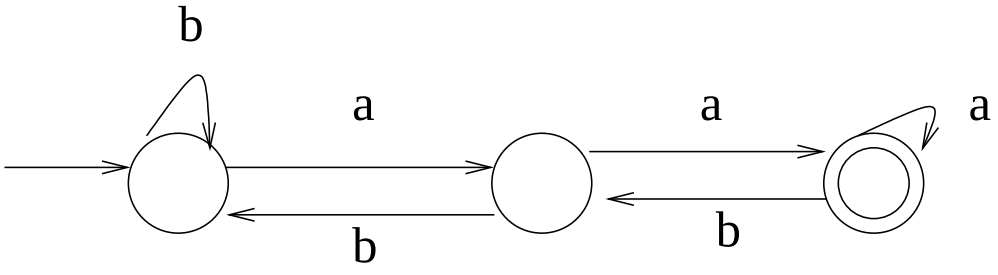


Figure for #3b

(b) Describe the language accepted by this finite automaton:

4. Let $L, L' \subseteq \Sigma^*$. Define the following languages.

   - $Pref(L) = \{w \in \Sigma^* : \ x = wy \ for \ some \ x \in L, y \in \Sigma^*\}$ (the set of **prefixes** of L).
   - $Suf(L) = \{w \in \Sigma^* : \ x = yw \ for \ some \ x \in L, y \in \Sigma^*\}$ (the set of **suffixes** of L).
   - $Subseq(L) = \{w_1 w_2 \cdots w_k : \ k \in \mathbb{N}, \ w_i \in \Sigma^* \ for \ i = 1, \ldots, k, \ and$ $there \ is \ a \ string \ x = x_0 w_1 x_1 w_2 x_2 \cdots w_k x_k \in L\}$ (the set of **subsequences** of L).
   - $Max(L) = \{w \in L : \ if \ x \neq \varepsilon \ then \ wx \notin L\}$.

   Show that if L is accepted by some finite automaton, then so is each of the following.

   (a) $Pref(L)$.

   (b) $Suf(L)$.

(c) $Subseq(L)$.

(d) $Max(L)$.

5. Find the ε-closure of each of the states of the following NFA, and convert it into an equivalent DFA.