

HOMEWORK 1—CSC 320 FALL 2015

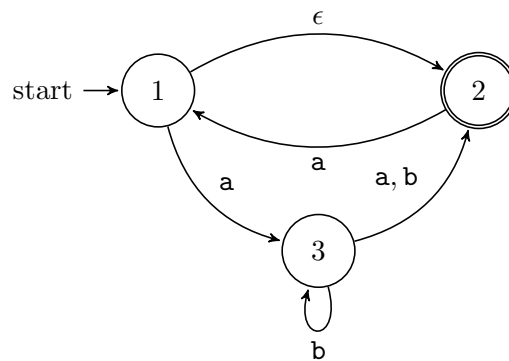
Due in class on Tuesday September 29

(1) Let

$D = \{w \mid w \text{ contains an even number of } a\text{'s}$
and an odd number of $b\text{'s} \text{ and does not contain the substring } ab\}$

Give a DFA with five states that recognizes D and a regular expression that defines D . (Suggestion: think of a simpler way to describe D first.)

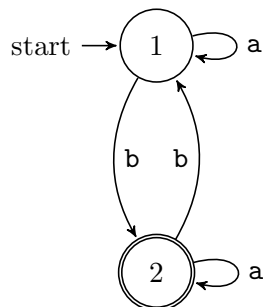
- (2) Let L_1 be the set of strings over $\{a, b\}^*$ that contain at least two a 's and L_2 be the set of strings over $\{a, b\}^*$ that contain at most two a 's.
- (a) Give a DFA for L_1
 - (b) Give a DFA for L_2
 - (c) Using the product construction shown in class, give a DFA for $L_1 \cup L_2$. Show all states, even those that are inaccessible.
- (3) Use the construction given in class to convert the following NFA to a DFA. Give a transition table and a transition diagram for the resulting DFA.



- (4) Use the procedure given in class to convert the following regular expression to an NFA

$$(((00)^*(11)) \cup 01)^*$$

- (5) Use the procedure given in class to convert the following DFA to a regular expression



- (6) Give a construction that shows that if A and B are regular, so is

$$A/B = \{w \mid wx \in A \text{ for some } x \in B\}$$

- (7) For languages A and B , define the *shuffle* of A and B to be the language

$$\{w \mid w = a_1 b_1 \dots a_k b_k, \text{ where } a_1 \dots a_k \in A \text{ and } b_1 \dots b_k \in B, \text{ and } a_i, b_i \in \Sigma^*, 1 \leq i \leq k\}$$

Give a construction that shows that the regular languages are closed under shuffle.