

## HOMEWORK 1–CSC 320 SUMMER 2015

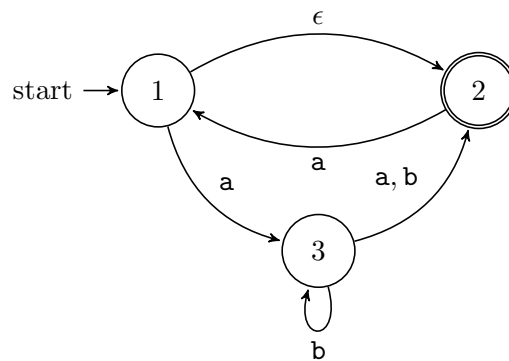
Due in class on Friday May 22

(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.)

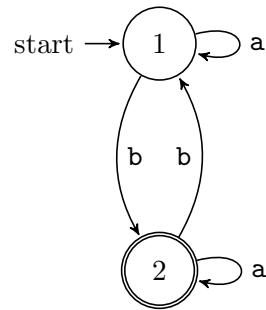
- (2) Let  $L_1$  be the set of strings over  $\{a, b\}^*$  that contain at least two  $a$ 's and  $L_2$  be the set of strings over  $\{a, b\}^*$  that contain at most two  $a$ 's.
- (a) Give a DFA for  $L_1$
  - (b) Give a DFA for  $L_2$
  - (c) Using the product construction shown in class, give a DFA for  $L_1 \cup L_2$ .
- (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

$$\{w \mid w = a_1b_1 \dots a_kb_k, \text{ where } a_1 \dots a_k \in A \text{ and } b_1 \dots b_k \in B, \text{ and } a_i, b_i \in \Sigma^*, 1 \leq i \leq k\}$$

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