

This homework on Sections 3.4, 3.5, and 3.6 is due on Wednesday, April 8. Work should be submitted through Canvas. See "Homework 7" under "Assignments" in canvas

1. For each of the following languages, draw a transition diagram for a DFA that accepts the language. That is, it accepts all the strings in the language and no other strings. (The alphabet for the DFA is the same as the alphabet for the language.)

- a)  $\{w \in \{a, b, c\}^* \mid n_a(w) + n_b(w) \text{ is not a multiple of } 3\}$  [Note the alphabet! Your machine must be able to read  $c$ 's as well as  $a$ 's and  $b$ 's.]
- b)  $\{w \in \{a, b\}^* \mid w \text{ contains the string } baab\}$
- c) The language over  $\Sigma = \{a, b\}$  generated by the regular expression  $(b|aab)^*$ .

2. Suppose that a DFA  $M$  is defined as  $M = (Q, \Sigma, p_1, \delta, F)$ , where:

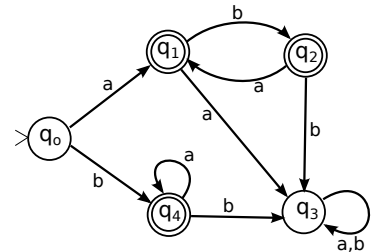
$$Q = \{p_1, p_2, p_3, p_4\} \quad \Sigma = \{a, b, c\} \quad F = \{p_2, p_4\}$$

and  $\delta$  is given by the table shown at the right.

	$p_1$	$p_2$	$p_3$	$p_4$
$a$	$p_2$	$p_2$	$p_3$	$p_3$
$b$	$p_4$	$p_3$	$p_3$	$p_4$
$c$	$p_1$	$p_3$	$p_3$	$p_4$

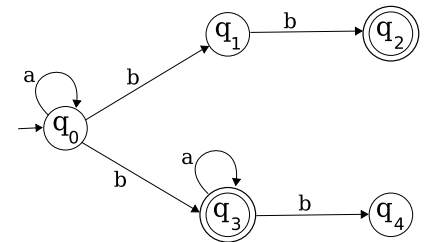
- a) Draw a transition diagram for  $M$ .
- b) Based on your diagram, write a regular expression for the language that is accepted by  $M$ , and briefly explain your reasoning.

3. Consider the DFA that is defined by the transition diagram shown at the right.



- a) Suppose that this DFA is given formally as  $M = \{Q, \Sigma, q_0, \delta, F\}$ . Identify  $Q$ ,  $\Sigma$ ,  $\delta$ , and  $F$ . For  $\delta$ , give the transition table.
- b) Find a regular expression for the language that is accepted by this DFA. Explain your reasoning.

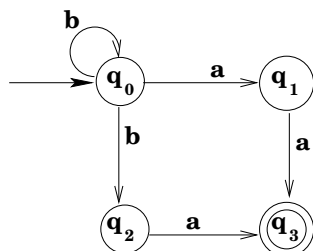
4. Consider the NFA that is defined by the transition diagram shown at the right. Determine which of the following strings are accepted by this NFA. (Just list the accepted strings.) Then find a regular expression for the language that is accepted by the NFA.



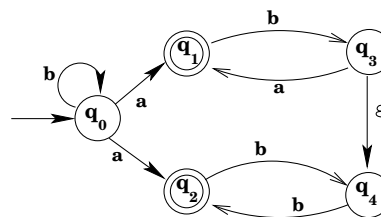
- a)  $aaab$       b)  $aabb$       c)  $bbbbbb$       d)  $bb$
- e)  $bbb$       f)  $baaaa$       g)  $aaabab$       h)  $baaabab$

5. For each of the following NFAs, use the NFA-to-DFA conversion algorithm to find a DFA that accepts the same language as the NFA.

a)



b)



6. For each of the following regular expressions, use the regular-expression-to-NFA conversion algorithm to find an NFA that accepts the language that is generated by the expression. Do not just give an NFA that accepts the same language; show the NFA that is constructed by the algorithm.

- a)  $a^*bc^*$       b)  $(a|b)^*(aaa|bbb)$       c)  $(aa|bb)c^*(a|b|c)$