

Due: Before class on February 18, 2014

Homework 3

1. Did you do the reading? YES/NO/SORTA
2. Did you do the reading before class? YES/NO/SORTA
3. How long did you spend on this homework (rounding up)? _____ hours.

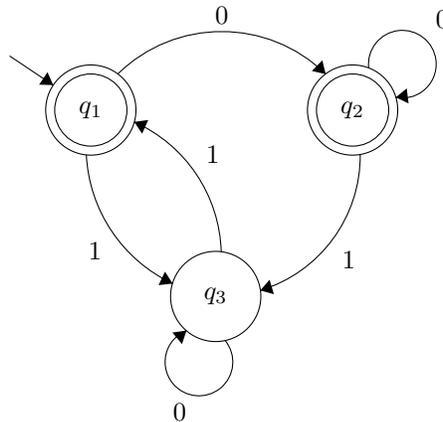
1 Regular Expressions

1.1 Give a regular expression to describe the following languages over the alphabet $\Sigma = \{a, b, c\}$.

- $\{w \mid w \text{ begins with } a \text{ and ends with } b\}$
- $\{w \mid \text{every odd position of } w \text{ is } c\}$
- $\{w \mid w \text{ has length at most } 4\}$
- $\{w \mid w \text{ is any string other than } abc\}$

2 Converting Regular Expressions to NFAs and back

2.1 (1) Take the following DFA M and add a unique start state and a unique accept state to make an equivalent GNFA.



(2) Remove state q_3 using the method described in class to make a GNFA with one fewer state. Draw the new state diagram.

(3) Remove state q_2 using the method described in class to make a GNFA with one fewer state. Draw the new state diagram.

(4) Give a regular expression r such that $L(r) = L(N)$.

3 The Pumping Lemma

3.1 In the book, it mentions that the language of all binary strings ($\Sigma = \{0, 1\}$) with an equal number of 01 and 10 substrings is regular. Now consider the language L_1 of binary strings with twice as many 01 substrings as 10 substrings. Is L_1 regular? If so, give a DFA that recognizes it. Otherwise, use the pumping lemma to prove that L_1 is not regular. *In case you are wondering, this is a trick question. There's a trick.*

3.2 Let $L_2 = \{ww|w \in \{0, 1\}^*\}$. Is L_2 regular? If so, give a DFA that recognizes it. Otherwise, use the pumping lemma to prove that L_2 is not regular.

3.3 Let $\Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, \times, =\}$ and let

$$L_3 = \{a \times b = c \mid a, b, c \text{ are positive integers (written in decimal) and } a \times b = c\}.$$

Prove that L_3 is not regular.

To think about : What if a and b are also required to be less than 100? Would that make L_3 regular? *Just ponder this one.*