Introduction to Computer Science Theory (4003-380-01)
Prof. Richard Zanibbi (20103, Spring 2011)
Homework 4, Due 4pm, Tuesday April 5, 2011

All question are written: submit through myCourses or on paper before the state of class. If you work in a group of two, submit your answers only once, and make sure to include both your names on your submitted work.

Questions indicated using numbers are from the course textbook (Sipser).

Questions (50 points in total)

1. Question 1.21
2. Consider the following language, from alphabet $\Sigma = \{a, b, c\}$:

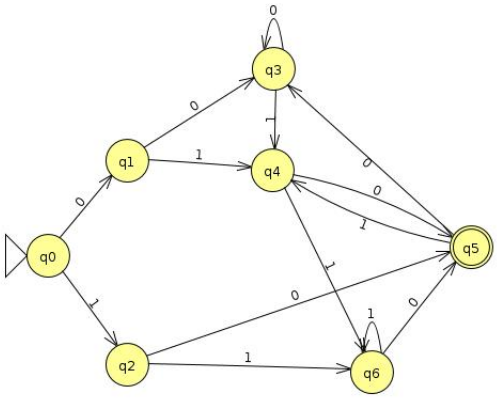
$$A = \{w \mid (N_a(w) \; mod \; 3) = 0\}$$

where $N_a(s)$ is the number of a's in string s.

(a) Give a regular expression that describes this language.

(b) Using this regular expression, construct an NFA N where $L(N) = A$. You should use the constructions discussed in class and in the text (in the proof-by-construction for Lemma 1.55, p. 67); provide only the final NFA. You do not need to simplify the machine.

3. Provide a minimal finite automaton for the following DFA.



4. Consider the language described by the regular expression (aa)*b*.

(a) Draw a minimal DFA for this language.

(b) Prove that your DFA is of minimum size. You may use the minimization algorithm presented in class, or the Myhill-Nerode Theorem.

5. Use the pumping lemma to show that the following language is nonregular:

$$L = \{0^i 1 0^{2i} \mid i \geq 0\}.$$

You must provide a complete proof.

6. Question 1.29 part b. Again, provide a complete proof that the language is not regular, using the pumping lemma.

7. Question 1.30

8. Question 1.45