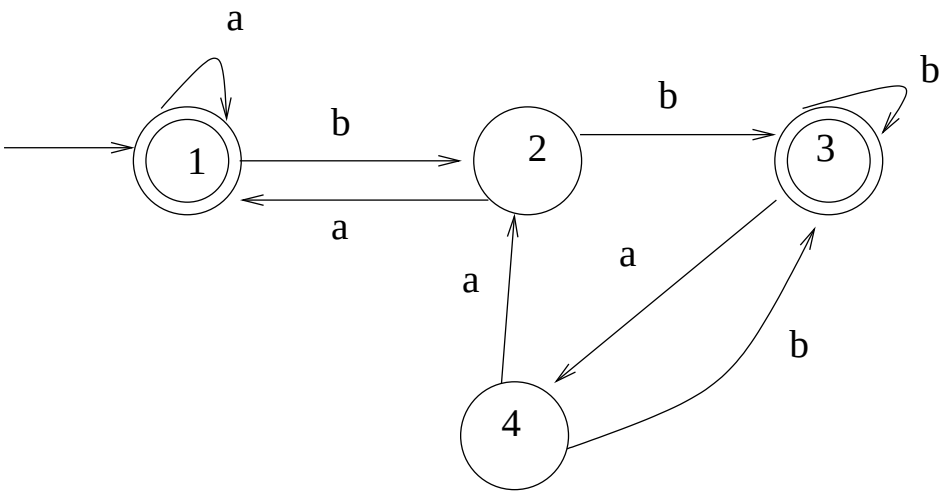
CS341 Automata Theory

Summer 2008

Midterm Practice Problems

1. Define a deterministic finite automaton for the following languages:
   (a) $L = \{w \in \{0,1,...9\}^* | w$ represents an odd natural number with no leading 0s$\}$
   (b) $L = \{w \in \{0,1,2\}^* | w$ does not end in 12$\}$
   (c) $L = \{w \in \{a,b\}^* | w$ contains the string aba or w does not contain aa$\}$
2. Define an NFA that recognizes the following languages:
   (a) $L = \{w \in \{a,b\}^* | w$ contains at least one instance of abaa, abbb, or baab$\}$
   (b) $L = \{a^n b a^m | n, m \geq 0, n \equiv_3 m\}$
   (c) $L = \{w \in \{a,b,c\}^* | w$ contains substring abb and substring bbc$\}$
3. Describe concisely the language described by the regular expression.
   (a) $(a^*a)b \cup b$
   (b) $(a^*b^*)^*ab \cup (a^*b^*)^*ba(b \cup a)^*$
4. Write a regular expression that represents the following languages.
   (a) $L = \{w \in \{a,b\}^* | \#_a(w) \leq 5\}$
   (b) $L = \{w \in \{a,b\}^* | \#_a(w) \equiv_3 0\}$
   (c) $L = \{w \in \{a,b\}^* | w$ contains exactly one occurrence of string aa$\}$
5. Use the algorithm presented in class to convert the regular expression $(0 \cup 1)^*000(0 \cup 1)^*$ to an NFA.
6. Convert the following finite automaton to a regular expression using the algorithm given in class.



7. 1.29 in Sipser
8. 1.30 in Sipser
9. 1.40a in Sipser
10. 1.46bd in Sipser
11. True or False:
    (a) The union of an infinite number of regular languages is regular.
    (b) The intersection of an infinite number of regular languages is regular.
    (c) Every subset of a regular language is regular.
12. 2.3 in Sipser
13. 2.4
14. 2.8
15. 2.6a
16. 2.30abc (Save this one for final exam practice - we haven't covered the CFL Pumping Lemma yet)
17. 2.5