CS352 - Compilers: Principles and Practice
Homework 1
Due: 2003 October 9, beginning of lecture

1. Draw the finite state machines, and write regular expressions that denote the strings recognized by the following finite automata:

   (a) s_1 is the start state; s_2 is the final (accepting) state

	a	b
s_1	s_2	
s_2		s_1

   (b) s_1 is the start state; s_3 is the final state

	a	b
s_1	s_2	s_3
s_2	s_3	
s_3		s_3

   (c) s_1 is both the start state and the final state

	a	b
s_1	s_2	
s_2	s_3	s_1
s_3	s_3	s_2

   (d) s_4 is both the start state and the final state

	a	b	c
s_1	s_4		
s_2		s_4	
s_3			s_4
s_4	s_2	s_1	s_3

   (e) s_1 is the start state; s_6 is the final state

	a	b
s_1	s_2	s_4
s_2	s_3	s_2
s_3	s_4	s_6
s_4	s_5	s_3
s_5	s_5	s_6
s_6	s_6	s_6

2. Write DFA's that recognize the following languages:

   (a) $\{w \in \{a, b\}^* :$ each a in w is followed by a pair of b's $\}$
   (b) $\{w \in \{a, b\}^* : w$ has no consecutive a's $\}$
   (c) $\{w \in \{a, b\}^* : w$ has an even number of a's and an odd number of b's $\}$
   (d) $\{w \in \{a, b\}^* : w$ has $abba$ as a substring $\}$
   (e) $\{w \in \{a, b\}^* : w$ has both baa and abb as a substring $\}$

3. Consider the following regular expression:

   $(aab \mid abb)^*$

   (a) As described in class, construct an NFA for this expression.
   (b) Using subset construction, convert the NFA into a DFA.
   (c) Optimize the DFA to minimize the number of states.