

## Problem Set 3 — Due January 25, 2005

**Problem 1.** Let  $L = \{w : w \text{ is a binary string of length at least 1 that starts and ends with the same character}\}$ . Show that 5 states is necessary and sufficient for a DFA to recognize  $L$ .

**Problem 2.** Page 85, Exercise 1.12.

**Problem 3.** Page 90, Problem 1.41.

**Problem 4.** Prove that the DFA-acceptable languages are closed under reversal.

**Problem 5.** Find a simple and nontrivial characterization of the language  $\{111\}^*\{11111\}^*$  and prove correct your characterization.

**Problem 6.** (*For whiz-kids only—no soln to be given—turn in correct soln directly to Prof. Rogaway*)  
Prove that if  $L \subseteq \{1\}^*$  then  $L^*$  is regular.