Finite Automata and Formal Languages Midterm Exam November 12, 2003 CSIE210030, National Chi Nan University

Problem 1 Design a DFA that accepts all strings over $\{0,1\}$ containing 00101 as substring.

Problem 2 Prove that the class of regular languages is closed under the union operation.

Problem 3 Convert the following NFA into DFA.



Problem 4 Suppose that $L_1 \cup L_2$ is regular. Can you conclude that L_2 is regular? What happens if L_1 is finite? Prove your claim.

Problem 5 State Pumping Lemma for regular languages. Use Pumping Lemma to prove

$$\{ww^{\mathcal{R}}: w \in \{0,1\}^*\}$$

where $w^{\mathcal{R}}$ is the *reverse* of w (e.g., $(001)^{\mathcal{R}} = 100$) is not regular.

Problem 6 Prove that

$$L = \{a^m b^n : n \neq m \text{ and } m, n \ge 0\}$$

is not regular.

Problem 7 Is the language

 $L = \{w : w \text{ contains even number of 0s and even number of 1s over } \{0, 1\}\}$

regular? Prove your claim.