## Finite Automata and Formal Languages <br> Midterm Exam <br> November 12, 2003 <br> 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

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

where $w^{\mathcal{R}}$ is the reverse of $w$ (e.g., $(001)^{\mathcal{R}}=100$ ) is not regular.
Problem 6 Prove that

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

is not regular.
Problem 7 Is the language
$L=\{w: w$ contains even number of 0 s and even number of 1 s over $\{0,1\}\}$ regular? Prove your claim.

