

# Theory of Computation

Midterm Examination

CSIE210039

National Chi Nan University

April 24, 2007

**Problem 1 (25 points)** Determine the satisfiability of the following set of clauses:

$$\neg x \vee \neg y, \neg y \vee \neg z, \neg z \vee \neg x, \\ x \vee \neg w, y \vee \neg w, z \vee \neg w, x \vee y \vee z \vee w.$$

**Problem 2 (25 points)** Show that if both languages  $L$  and  $\bar{L}$  are recursively enumerable, then  $L$  is recursive.

**Problem 3 (25 points)** Let  $A$  be the set of strings generated by the following context-free language:

$$S \rightarrow (S) \mid SS \mid \epsilon$$

where  $\epsilon$  is the empty string. That is,  $A$  contains the set of all paired parentheses such as  $(( ))$  or  $(())(())$ . Prove that  $A$  can be decided by a deterministic multi-string Turing machine in log space. (Note: You can just sketch the idea of the machine. No transition function is required here.)

**Problem 4 (25 points)** Let  $B = \{ \langle M \rangle \mid L(M) \text{ is finite} \}$  where  $\langle M \rangle$  is the encoding of machine  $M$  and  $L(M)$  is the language accepted by  $M$ . Show that  $B$  is undecidable.