

# 國立交通大學試題紙

科目：計算理論(A)

日期：99 年 1 月 27 日 第 1 頁 共 1 頁

請“✓”明    ✓不可看書    可看書

\* 請將答案依題號順序寫入答案卷

答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. (10%) Prove or disprove that the following language

$$L_1 = \{wwrt \mid w, t \in \{a, b\}^+, |w| \geq 1\}$$

is regular, where  $w^R$  denotes the reverse of string  $w$ .

2. (10%) Prove or disprove that if  $A$  and  $B$  are both nonregular,  $A \cup B$  is also nonregular.

3. (10%) Prove or disprove that the following language

$$L_3 = \{a^i b^j c^k \mid i, j, k \geq 0, i + k = j\}$$

is context free.

4. (10%) Prove or disprove grammar  $G_4 = (\{S\}, \{a, b\}, P, S)$ , where  $P$  contains the following productions:

$$S \rightarrow aSb \mid SS \mid \varepsilon,$$

is ambiguous.

5. (10%) Prove or disprove that the language denoted by grammar  $G_4$ , i.e.,  $L(G_4)$ , is inherently ambiguous.

科目：計算理論(B)

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6. (7%) Consider the following Turing Machine  $M$ , where  $q_0$  is the start state,  $q_f$  is the accepting state and  $B$  is blank symbol. Deduce what  $M$  does on any string in  $\{0, 1\}^*$ .

Table 1: Turing machine  $M$ 

$\delta(q, a)$	0	1	$B$
$q_0$	$(q_0, 1, R)$	$(q_1, 1, R)$	$(q_f, B, R)$
$q_1$	$(q_2, 0, L)$	$(q_2, 1, L)$	$(q_2, B, L)$
$q_2$	-	$(q_0, 0, R)$	-
$q_f$	-	-	-

7. (8%) Show how to reduce the *Modified Post's Correspondence Problem* (MPCP) to the *Post's Correspondence Problem* (PCP).
8. (24%) Define  $L_1 = \{\langle M \rangle \mid L(M) = \emptyset\}$ ,  $L_2 = \{\langle M \rangle \mid L(M) \neq \emptyset\}$ . (1) Prove that  $L_2$  is RE (i.e. Turing recognizable). (2) Prove that  $L_2$  is not recursive (i.e. not decidable). (3) Prove that  $L_1$  is not RE (i.e. not Turing recognizable).
9. (11%) If there is an algorithm  $A$  that can decide SAT in polynomial time, give a polynomial time algorithm that can produce a truth assignment when given a satisfiable Boolean formula as input.