

科目：計算理論 A

日期：104 年 1 月 26 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. (15%) An integer function  $f:D \rightarrow N$  has a finite domain if the size of the domain  $D$  is a finite subset of  $N$ . Let  $A$  be the set of integer functions that have finite domains. Show that the set  $A$  is countable.
2. (15%) Show that the following problem is unsolvable: given a C program  $p$ , determine whether there is an input-output pair  $(x, w)$  of strings such that  $p(x)=w$ ?
3. (20%) Consider the clique problem: given an undirected graph  $G=(V, E)$  and a positive integer  $k$ , determine whether  $G$  contains a complete subgraph of  $k$  or more nodes.
  - (a) Show that the clique problem is in NP.
  - (b) Show that we can reduce the SAT problem to the clique problem in polynomial time. The SAT problem is, for given  $(V, F)$ , to determine whether the conjunctive normal form Boolean formula  $F$  is satisfiable, where  $V$  is the set of Boolean variables used in  $F$ .

◎ 請用深黑色鋼筆或原子筆出題

命題老師簽名：

科目：計算理論 B

日期：104 年 1 月 26 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%) Let  $\Sigma = \{0, 1\}$  and  $A$  be any language over  $\Sigma$ . Prove or disprove that  $A = A^+$  if and only if  $AA \subseteq A$ .
  2. (10%) Let  $\Sigma = \{0, 1\}$ . Prove or disprove that  $L = \{ w \mid w \text{ contains an equal number of occurrences of the substrings } 0 \text{ and } 1 \}$  is regular.
  3. (10%) Let  $\Sigma = \{0, 1\}$ . Prove or disprove that  $L = \{ w \mid w \text{ contains an equal number of occurrences of the substrings } 01 \text{ and } 10 \}$  is regular.
  4. (10%) Let  $\Sigma = \{0, 1\}$ . Prove or disprove that  $L = \{ xyz \mid x, z \in \Sigma^* \text{ and } y \in \Sigma^* 1 \Sigma^*, \text{ where } |x| = |z| \geq |y| \}$  is context-free.
  5. (10%) Let  $\Sigma = \{0, 1\}$ . Prove or disprove that  $L = \{ xyz \mid x, z \in \Sigma^* \text{ and } y \in \Sigma^* 1 \Sigma^* 1 \Sigma^*, \text{ where } |x| = |z| \geq |y| \}$  is context-free.
- 

◎ 請用深黑色鋼筆或原子筆出題

命題老師簽名：