

科目：計算理論(A)

日期：101 年 7 月 25 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.

Define the following languages

- $A = \{\langle M, w \rangle \mid M \text{ is a Turing machine and } M \text{ accepts } w\}$,
- $B = \{\langle M \rangle \mid M \text{ is a Turing machine and } L(M) = \emptyset\}$,
- $C = \{w \mid \text{either } w = 0x \text{ for some } x \in A, \text{ or } w = 1y \text{ for some } y \in \overline{A}\}$.

1. (15%) Answer the following questions.

- (a) Is A decidable? Prove your answer.
- (b) Is \overline{B} Turing-recognizable? Prove your answer.
- (c) Is A mapping reducible to B ? Prove your answer.

2. (20%) Prove that neither C or \overline{C} is Turing-recognizable.3. (15%) Let ϕ be a 3CNF-formula. We say ϕ is NAE-satisfiable if there is a truth assignment such that ϕ is satisfied and in each clause of ϕ not all literals are set to be true. Define $\text{NAE-SAT} = \{\phi \mid \phi \text{ is NAE-satisfiable}\}$.

A cut in an undirected graph is a separation of the vertices V into two disjoint subsets S and T . The size of a cut is the number of edges that have one endpoint in S and the other in T . Let $\text{MAX-CUT} = \{\langle G, k \rangle \mid G \text{ has a cut of size } k \text{ or more}\}$.

It is already known that NAE-SAT is NP-complete. Show how to reduce from NAE-SAT to MAX-CUT and prove that MAX-CUT is NP-complete.

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1. (10%) Show that if L is a regular language, so is L^R , where $L^R = \{w^R : w \in L\}$.
 2. (10%) Show that the language $L = \{a^n b^m : |n-m| < 3\}$ is not regular.
 3. (15%) Give a pushdown automata (PDA) for $L = \{w \in \{a,b\}^* : n_a(w) = n_b(w), w \text{ contains 'aab' as a string}\}$, where $n_a(w)$ is the number of 'a' in string w .
 4. (15%) Show that $L = \{a^n b^m c^k : n < m \text{ and } |m-k| > 2\}$ is not context-free.
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◎請用深黑色鋼筆或原子筆出題

命題老師簽名：