

科目：計算理論(A)

日期：101年1月16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. (20%) Consider the problem "Does a Turing machine ever enter a given state". Let $\langle \theta \rangle$ be the binary string encoding of object θ , where θ can be a machine, a state, a string, etc.
 - (a) What is the language L about the above problem?
 - (b) Show that L is recursively enumerable by enumerating the strings in L .
 - (c) Show that the above language is not recursive by reducing the language of the halting problem to it.
2. (30%) A language is in the complexity class NP if it can be accepted by some non-deterministic Turing machine in polynomial time. Let the language $CLIQ = \{ \langle G, k \rangle \mid \text{graph } G \text{ has a clique of size } k \}$ and $3SAT = \{ \langle F \rangle \mid F \text{ is a conjunctive Boolean formula in which each clause contains 3 literals} \}$
 - (a) Show that $CLIQ$ and $3SAT$ are both in NP .
 - (b) Assume that $3SAT$ is NP -complete. Show that the language $CLIQ$ is NP -complete.
 - (c) Assume that $CLIQ$ is NP -complete. Show that $3SAT$ is NP -complete.

◎ 請用深黑色鋼筆或原子筆出題

命題老師簽名：

國立交通大學試題紙

科目：計算理論(B)

日期：101 年 1 月 16 日 第 1 頁 共 1 頁

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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 every NFA can be converted to an equivalent one that has a single accept state.
2. (10%) Prove or disprove that if A is regular and $A \cup B$ is also regular, B is regular.
3. (10%) Prove or disprove that the following language

$$C = \{a^i b^j \mid i \neq j \text{ and } 2i \neq j\}$$

is context free.

4. (10%) Prove or disprove that the following language

$$D = \{a^i b^j \mid i \neq jk \text{ for every positive integer } k\}$$

is context free.

5. (10%) If E and F are languages, define

$$E \diamond F = \{xy \mid x \in E \text{ and } y \in F \text{ and } |x| = |y|\}.$$

Prove or disprove that if E and F are regular, $E \diamond F$ is context free.

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命題老師簽名：