

科目：計算理論 (A)

日期：98 年 7 月 22 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%) Define $L_1 = \{a^n b^{2k} \mid n \text{ and } k \text{ are nonnegative integers}\}$ and $L_2 = \{a^n b^{2n} \mid n \text{ is nonnegative integers}\}$. Are L_1 and L_2 regular? Prove your answer. There is no credit without proof.
2. (7%) Prove or disprove that L_3 is regular, where
$$L_3 = \{1^k y \mid y \in \{0, 1\}^* \text{ and } y \text{ contains at most } 2k \text{ 1's, for } k \geq 1\}.$$
3. (8%) Suppose $L \subseteq \Sigma^*$ and, for some positive integer n , there are n strings in Σ^* , any two of which are distinguishable with respect to L . Then any finite state automata recognizing L must have at least n states.
4. (10%) Let G be a CFG in Chomsky normal form that contains b variables. Prove or disprove that, if G generates some string with a derivation having at least 2^b steps, $L(G)$ is infinite.
5. (10%) State and prove the pumping lemma for context-free languages.

科目：計算理論 (B)

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6. (5%) Why can we use Turing machines as a computation model of modern computers?
7. (5%) What is the complexity class NP?
8. (20%) John would like to write a program to check whether a given C program has the security problem of overflow. Is it possible to write such program? Prove your answer.
9. (20%) The clique problem is to, for given graph G and integer k , determine whether graph G has a k -clique.
 - (1) Design a deterministic algorithm to solve the clique problem.
 - (2) Design a non-deterministic polynomial-time algorithm to solve the clique problem
 - (3) Show that the clique problem is NP-complete by reducing from the 3SAT problem.