

國立交通大學試題紙

九十九學年度第二次
· 博士班資格考

科目：計算理論(A)

日期：99年7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. Let $L = \{a^n b^m c^k \mid m = |n - k|, n, m, k \geq 0\}$.
 - (a) (10%) Write a context-free grammar for L .
 - (b) (10%) Design a pushdown automaton M to accept L . You need to specify M formally.
2. (15%) Let $L = \{a^n b^m \mid n = m^2, n, m \geq 0\}$. Show that L is not context-free.
3. (15%) Let $M = (Q, \Sigma, \delta, q_0, F)$ be a deterministic finite automaton. Consider the language $L_1 = \{v \mid uvw \in L(M), \text{ for some } u, w \in \Sigma^*\}$. Design a nondeterministic finite automaton M_1 to accept L_1 . You need to specify M_1 formally by using the components of M .

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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 that a language A is decidable if and only if $A \leq_m 0^*1^n$.
2. (10%) Let $L = \{\langle M, w \rangle \mid M \text{ is a Turing machine and } M \text{ accepts } w\}$. Use the diagonalization method to prove that L is undecidable.
3. (15%) Prove that if $P=NP$, then an algorithm exists that takes a formula $\phi(x_1, \dots, x_n)$ as input and finds a satisfying assignment in polynomial time or declares ϕ unsatisfiable. State and explain your method.
4. (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.