

科目：資料結構與演算法

適用：資工系三

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

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The following problems can be answered either in Chinese or English.

Problem 1 (20%) The Fibonacci numbers are defined recursively by the following formula:

$$F_0 = F_1 = 1, F_n = F_{n-1} + F_{n-2}, \text{ for } n \geq 2.$$

Write a program in C language to evaluate F_n in time $O(n)$.

Problem 2 (20%) We know that Kruskal's algorithm can solve the minimum spanning tree problem in time $O(m \log n)$ where m is the number of edges and n is the number of vertices, for any connected, undirected graph with weights on the edges. Show how to detect the existence of cycles efficiently when trying to add a new edge into the spanning forest in Kruskal's algorithm.

Problem 3 (15%) Given n integers, show how to construct a min-heap for these numbers in time $O(n)$.

Problem 4 (15%) Define the convex hull problem, provided n points p_1, p_2, \dots, p_n on the plane.

Problem 5 (15%) Suppose you were analyzing an algorithm and finally you got a recurrence relation for its time complexity as follows.

$$T(n) = T\left(\frac{3n}{4}\right) + T\left(\frac{n}{5}\right) + \Theta(n)$$

Solve this equation and derive a closed form for $T(n)$.

Problem 6 (15%) Explain the resolution principle and show how to use it to determine the satisfiability of Boolean formulas given in the conjunctive normal form.