

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Three of the following statements are incorrect. Pick out and correct them. (15 points)

(A) If $T(n)=2T(n/2)+O(n)$ and $T(1)=O(1)$, then $T(n)=O(n\log n)$.

(B) If $T(n)=T(n/2)+O(n)$ and $T(1)=O(1)$, then $T(n)=O(n)$.

(C) $n^{10}+1.1^n=O(n^{10})$ (D) $2n^2+1.5n\log^5 n=O(n^2)$

(E) The number of odd degree nodes in an undirected graph must be odd.

(F) To obtain the breadth first search tree of a graph, we need to use a stack data structure.

2. Suppose that you are asked to code a C function subprogram to compute the Fibonacci sequence, which is recursively defined as $F_n = F_{n-1}+F_{n-2}$, $F_0=F_1=1$. In particular, you are asked to get the value of F_{500} . Will you code it as a recursive function or an iterative function? Why? (10 points)

3. The following array represents a complete binary tree. Adjust it to be a max heap by **showing each step**. (15 points)

10	9	20	6	15	48	14	8	90	17
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4. (a) Give conditions under which quick sort algorithm has the worst case behavior in terms of time complexity. Explain your answer. (10 points)

(b) Which sorting algorithm(s) is (are) stable, bubble sort, quick sort, merge sort, heap sort? (10 points)

5. Let $G = (V, E)$ be a weighted undirected graph with any two vertices connected by at most one edge and H be a subgraph of G obtained by deleting an edge e_i from G , i.e., $H = (V, E-\{e_i\})$. True or false? Explain if false. (15 points)

(a) Minimal cost spanning tree of G is unique.

(b) The path from vertex A to vertex B on a minimal cost spanning tree of G is a shortest path from A to B .

(c) If the total cost of minimal cost spanning tree of H is greater than that of G , then e_i must be an edge in any minimal cost spanning tree of G .

6. Consider a sequence of keys : 27, 49, 17, 20, 61, 23, 92, 33, 77, 11, 31.

(a) Draw, **step by step** (showing clearly the type of rotation used), the result of inserting these keys into an empty AVL tree. (20 points)

(b) Write down the inorder sequence of the AVL tree in (a). (5 points)