

第一、二大題是非及單選題考生請作答於『選擇題作答區』

一、是非題 (20 分)

命題正確請填(A)，錯誤請填(B)

每題 2 分，答對得 2 分，答錯倒扣 2 分。整組是非題得分最低為 0 (扣分不影響其它大題)。

1. Starting from empty, with the same insertion sequence, a red-black tree is always shorter than or equal to an AVL-tree.
2. The complement of a cyclic graph is acyclic.
3. Let the height of binary search tree be h . Deleting an element costs $O(h)$ time.
4. The in-order traversal of a binary search tree uniquely decides the structure of the binary search tree.
5. Finding the maximum element of a hash table with n elements costs $O(\log n)$ time.
6. Linear probing suffers from primary clustering.
7. Double hashing does NOT suffer from secondary clustering.
8. In a red-black tree, the number of red nodes is less than the number of black nodes.
9. A binomial tree of height k contains $\Theta(2^k)$ nodes.
10. Given an undirected graph $G = (V, E)$ in the form of adjacency matrix, deciding whether a path existing between any two vertices can be done in $O(|V| + |E|)$ time.

二、單選題 (20 分)

每題 5 分，答對得 5 分，答錯倒扣 1 分。整組單選題得分最低為 0 (扣分不影響其它大題)。

11. We push a, b, c, and d in a stack in that exact order. After a certain number of operations, 4 sequential pops yield d, b, c, and a. That certain number of operations consist of at least
(A) 1 pop and 1 push (B) 2 pops and 2 pushes (C) 3 pops and 3 pushes (D) 4 pops and 4 pushes
(E) None of the above.
12. How many distinct binary search trees are there containing A, B, and C?
(A) 1 (B) 3 (C) 5 (D) 7 (E) None of the above.
13. The pre-order traversal of a binary search tree is 4, 3, 2, 1, 5. Its post-order traversal is
(A) 1, 2, 3, 4, 5 (B) 5, 4, 3, 2, 1 (C) 1, 3, 2, 5, 4 (D) 2, 1, 3, 5, 4 (E) None of the above.
14. We insert 1, 2, 3, 4, 5 in that exact order into an AVL-tree from empty. How many double rotation(s) occur?
(A) 1 (B) 2 (C) 3 (D) 4 (E) None of the above.

見背面

請於試卷內之「非選擇題作答區」標明題號依序作答。

三、(20 分) List the pros and cons for the following three data structures: (a) contiguous array, (b) singly-linked list, and (c) circular, doubly-linked list.

四、(20 分) Consider n numbers $a_i, i = 1, 2, \dots, n$, and a function $f(x, y)$ which can be computed in $O(1)$ time. Your task is to output the minimum of $f(a_i, a_j)$ for all $i, j = 1, 2, \dots, n$, and you need to output the minimum again if any number is modified. Suppose such modification (only one number at a time) occurs m times. Design and analyze an algorithm to accomplish such task. You need to describe the data structure you use in detail, including its implementation.

五、(20 分) Given an undirected graph $G = (V, E)$ in the form of adjacency matrix, design and analyze an algorithm to find all strongly connected components of G . You need to describe the data structure you use in detail, including its implementation.

試題隨卷繳回