

※ 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。

一、複選題： (10 分，全對才給分)

1. Given an undirected graph $G=(V, E)$, where V is a finite set of n vertices and E contains e pairs of vertices called edges, with no self-edge and multi-occurrence of the same edge, which of the following statements is(are) true?

- (A) If we represent G by its adjacency list, the depth-first search takes $O(e)$ time to complete the search.
- (B) If we represent G by its adjacency matrix, the depth-first search takes $O(n^2)$ time to complete the search.
- (C) If we represent G by its adjacency list, the breadth-first search can take $O(e)$ time to complete the search.
- (D) If we represent G by its adjacency matrix, the breadth-first search has to take at least $O(n^2)$ time to complete the search.
- (E) The connected-component can be found by calling either the depth-first search or the breadth-first search function in a graph.

二、問答題：

1. What are the contents from Front to Rear in a circular queue with size 4 after the following operations, [enqueue(A), enqueue(B), dequeue(), enqueue(C), enqueue(D), enqueue(E), dequeue(), dequeue(), enqueue(B), enqueue(A)]? (4 points)

2. Given an empty hash table of size 7 and bucket capacity 1 that uses open addressing. The following sequence of keys is to be inserted: (8, 17, 24, 3, 15, 5). Insert these keys using the following hash function and approach. Show the resulting hash table step by step. If overflow occurs, indicate the element that causes the overflow. (6 points)

$$h(x) = x \% 7; \text{quadratic probing.}$$

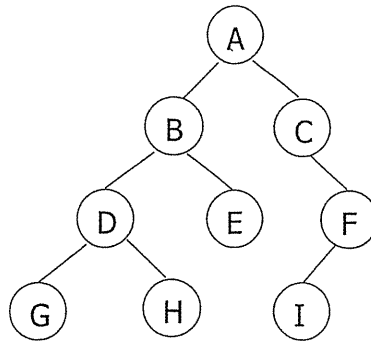
3. Given the following orders of traversal of a binary tree:

Postorder: G, D, B, H, I, E, F, C, A

Inorder: D, G, B, A, H, E, I, C, F

Is it possible to reconstruct the tree uniquely? If yes, reconstruct the tree and explain the reason, otherwise justify your answer. (10 points)

4. Please show the postorder and the level-order traversal of the following tree. (10 points)



5. Please sort the following sequence (15, 9, 3, 6, 13, 8, 2, 4) in the ascending order using merge sort algorithm. Show your answer step by step. (10 points)

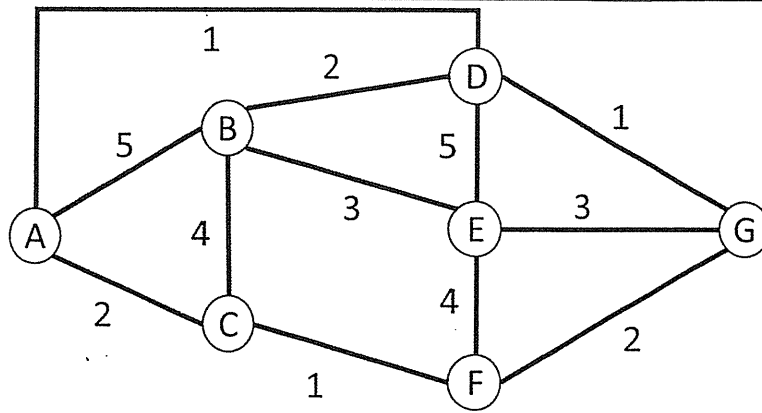
6. Draw a suffix trie for the following sequence, $S=acbababb$. Locate the position where "abb" occurs. (10 points)

7. An AVL (Adelson-Velsky and Landis) tree is a self-balancing binary search tree. Please draw the resulting AVL tree after inserting the following numbers under the root with no subtree. Please show your answer step by step. (10 points)

{add(8); add(9); add(10); add(2); add(1); add(5); add(3); add(6); add(4); add(7);}

8. Please compute the shortest distances from A to all the other nodes in the following graph. Please show your answer step by step. (15 points)

(see next page)



9. Given two sparse matrices as follows:

$$M_1 = \begin{bmatrix} 0 & 10 & 0 & 12 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 5 & 0 \\ 15 & 12 & 0 & 0 \end{bmatrix}, M_2 = \begin{bmatrix} 0 & 0 & 8 & 0 \\ 0 & 0 & 0 & 23 \\ 0 & 0 & 10 & 0 \\ 20 & 25 & 0 & 0 \end{bmatrix}$$

(A) Please use the linked list to represent the above two sparse matrices (5 points)

(B) Please compute the multiplication of two matrices, $M_1 \times M_2$, using linked list representations.

Please explain your method in details. (10 points)