

# 國立中山大學 109 學年度 碩士暨碩士專班招生考試試題

科目名稱：資料結構【資管系碩士班乙組】

## — 作答注意事項 —

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，不得另攜帶紙張，請斟酌作答。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，其後果由考生自行負擔。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- 試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

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題號：442002

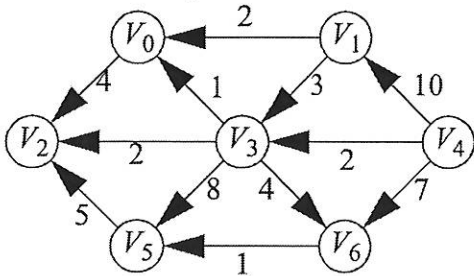
※本科目依簡章規定「不可以」使用計算機(選擇題)

共 5 頁第 1 頁

共 25 題選擇題，每題 4 分，第 1~24 題為單選題，第 25 題為複選題

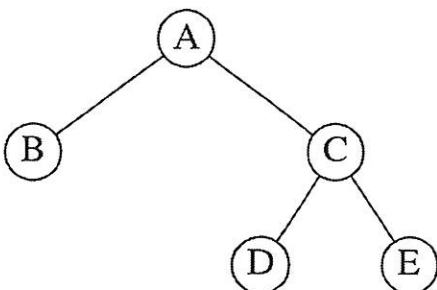
1. Items 7, 3, 11, 9, and 13 are inserted into an AVL tree. What happens when 12 is inserted?
  - A. No rotation is needed
  - B. A single rotation between some node and its left child is performed
  - C. A single rotation between some node and its right child is performed
  - D. A double rotation with a node, its left child, and a third node is performed
  - E. A double rotation with a node, its right child, and a third node is performed
  
2. Which of the following trees can have height that is not logarithmic?
  - A. AA tree
  - B. AVL tree
  - C. B-tree of order 4
  - D. Red black tree
  - E. All of the above trees must have logarithmic depth

The next two questions refer to the following graph:



3. If the start vertex is  $V_4$ , then using the acyclic weighted shortest path algorithm, which is the last vertex to be declared known?
  - A.  $V_0$
  - B.  $V_1$
  - C.  $V_2$
  - D. The graph is not acyclic, so the acyclic algorithm should not be used
  - E. None of the above
  
4. If the start vertex is  $V_4$ , then using the standard weighted shortest path algorithm, which is the last vertex to be declared known?
  - A.  $V_0$
  - B.  $V_1$
  - C.  $V_2$
  - D.  $V_4$
  - E. None of the above

The next two questions relate to the tree below:



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共 5 頁第 2 頁

5. Which of the following is an in-order traversal of the tree?
  - A. ABCDE
  - B. ABDCE
  - C. BDECA
  - D. EDCBA
  - E. None of the above
  
6. Suppose the post-order iteration is performed on the tree. At the time that D is output, what symbols are still on the stack?
  - A. A only
  - B. A and B, only
  - C. A and C, only
  - D. A, B, and C
  - E. None of the above
  
7. Which of the following sorting algorithms has the lowest worst-case time complexity?
  - A. Selection sort
  - B. Merge sort
  - C. Bubble sort
  - D. Insertion sort
  - E. Quick sort
  
8. What is the height of a complete binary tree with 16384 nodes?
  - A. 8192
  - B. 13
  - C. 14
  - D. 15
  - E. 16
  
9. A node with key 8 has a left child with key 10. Which of the following objects could this node be found in?
  - A. Binary search tree
  - B. Max heap
  - C. Min heap
  - D. Two of the above
  - E. None of A, B, and C
  
10. Suppose we are implementing quadratic probing with a hash function  $\text{Hash}(X) = X \bmod 100$ . If an element with key 4592 is inserted and the first three locations attempted are already occupied, then the next cell that will be tried is
  - A. 0
  - B. 1
  - C. 9
  - D. 92
  - E. 95

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共 5 頁第 3 頁

11. For the array implementation of the stack, what is the worst-case cost of a single push operation if array doubling is used?
- A.  $O(1)$
  - B.  $O(\log N)$
  - C.  $O(N)$
  - D.  $O(N \log N)$
  - E. None of the above
12. If a header node is used in a linked list, which of the following indicates a list with one item?
- A. `header != NULL`
  - B. `header == NULL`
  - C. `header != NULL && header->next == NULL`
  - D. `header != NULL && header->next != NULL && header->next->next == NULL`
  - E. None of the above
13. Which of the following characterizes a Huffman coding tree?
- A. All items are stored at the leaves
  - B. No nodes have one child
  - C. The tree is balanced
  - D. A and B only
  - E. All three of A, B and C

The next two questions apply to the following code fragment:

```
1 for( int i = 0; i < n; i++ )
2     for( int j = i; j <= n; j++ )
3         for( int k = i; k <= j; k++ )
4             sum++;
5 for( int p = 0; p < n*n; p++ )
6     for( int q = 0; q < p; q++ )
7         sum--;
```

14. How many times is statement 4 executed?
- A.  $O(N)$
  - B.  $O(N^2)$
  - C.  $O(N^3)$
  - D.  $O(N^4)$
  - E. None of the above
15. How many times is statement 7 executed?
- A.  $O(N)$
  - B.  $O(N^2)$
  - C.  $O(N^3)$
  - D.  $O(N^4)$
  - E. None of the above

16. What is the running time of the following routine?

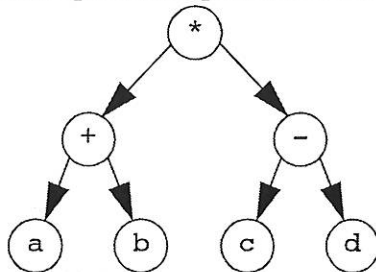
```
bool isPrime( int n ) {
    if( n == 2 || n == 3 )
        return true;
    if( n % 2 == 0 )
        return false;
    for( int i = 3; i <= squareRoot( n ); i+=2 )
        if( n % i == 0 )
            return false;
    return true;
}
```

- A.  $O(1)$
- B.  $O(\log N)$
- C.  $O(N)$
- D.  $O(N^{1/2})$
- E. None of the above

17. Which data structure is used by the compiler to implement recursion?

- A. Map
- B. Priority queue
- C. Queue
- D. Set
- E. Stack

18. What postfix expression does the expression tree below represent?



- A.  $a + b * c - d$
- B.  $(a + b) * (c - d)$
- C.  $a b + c d - *$
- D.  $a b c d + - *$
- E. None of the above

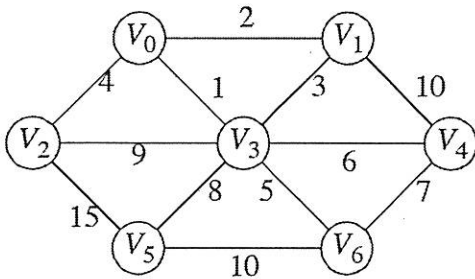
19. Which of the following represents an infix expression followed by the postfix equivalent?

- A.  $a+b-c$  and  $a b c - +$
- B.  $a+b*c$  and  $a b c * +$
- C.  $a+b*c$  and  $a b c + *$
- D.  $a+b*c$  and  $a b + c *$
- E. More than one of the above

20. The items 3, 6, 5, 2, 4, 7, 1 are inserted into a binary search tree. Which node is the deepest?

- A. 1
- B. 3
- C. 4
- D. 7
- E. None of the above

21. What is the cost of the minimum spanning tree for the following graph?



- A. 24  
 B. 25  
 C. 26  
 D. 27  
 E. None of the above
22. Approximately what is the maximum height of a binary search tree of  $N$  nodes?  
 A.  $\log N$   
 B.  $1.38 \log N$   
 C.  $1.44 \log N$   
 D.  $2 \log N$   
 E. None of the above
23. Which operation is not supported in constant time by a double-ended queue?  
 A. Insertion at the front or rear item  
 B. Access of the front or rear item  
 C. Deletion of the front or rear item  
 D. Access and deletion of the minimum item  
 E. All of the above are supported
24. Which of the following algorithm types classifies Huffman's algorithm?  
 A. Backtracking algorithm  
 B. Divide and conquer algorithm  
 C. Dynamic programming algorithm  
 D. Greedy algorithm  
 E. None of the above
25. (複選) Which ones of the following are true?  
 A. A full binary tree is a complete binary tree, and vice versa  
 B. When using a max heap to implement a priority queue, the time complexity of both the push and pop operations are  $O(\log N)$   
 C. The stack operations are according to the last-in first-out principle  
 D. The average time complexity of finding an element in a binary search tree is  $O(N)$   
 E. The linked list operations are according to the last-in first-out principle