

※ 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、選擇題 (50 分，每題 5 分)

1. With what data structure can a priority queue be implemented most efficiently?
 - a) Array
 - b) List
 - c) Heap
 - d) Tree

2. Which of the following is not an application of priority query?
 - a) Huffman codes
 - b) Interrupt handling in operating system
 - c) Undo operation in text editors
 - d) Bayesian spam filtering

3. When does the `ArrayIndexOutOfBoundsException` occur?
 - a) Compile-time
 - b) Run-time
 - c) Not an error
 - d) Not an exception at all

4. Which of the following concepts make extensive use of arrays?
 - a) Binary trees
 - b) Scheduling of processes
 - c) Caching
 - d) Spatial locality

5. What is an AVL tree?
 - a) a tree which is balanced and is a height balanced tree
 - b) a tree which is unbalanced and is a height balanced tree
 - c) a tree with three children
 - d) a tree with at most 3 children

6. In a max-heap, element with the greatest key is always in which node?
 - a) Leaf node
 - b) First node of left sub tree

- c) root node
 - d) First node of right sub tree
7. An array consists of n elements. We want to create a heap using the elements. The time complexity of building a heap will be in order of
- a) $O(n \cdot n \cdot \log n)$
 - b) $O(n \cdot \log n)$
 - c) $O(n \cdot n)$
 - d) $O(n \cdot \log n \cdot \log n)$
8. Which of the following is the most widely used external memory data structure?
- a) AVL tree
 - b) B-tree
 - c) Red-black tree
 - d) Both AVL tree and Red-black tree
9. Which of the following is true?
- a) B + tree allows only the rapid random access
 - b) B + tree allows only the rapid sequential access
 - c) B + tree allows rapid random access as well as rapid sequential access
 - d) B + tree allows rapid random access and slower sequential access
10. The optimal data structure used to solve Tower of Hanoi is _____
- a) Tree
 - b) Heap
 - c) Priority queue
 - d) Stack

二、問答題 (50 分)

1. Explain the following terms. (20)
- a) Associative array
 - b) Lossless compression
 - c) Regular expression
 - d) Bin packing problem
2. Show the results of adding the following numbers into an initially empty binary search tree: (10)
- 13, 3, 4, 12, 14, 10, 5, 1, 8, 2, 7, 9, 11, 6, 18

3. Please use Dijkstra's algorithm to solve the shortest path problem by calculating the shortest distance from the source (node 1) to every other node in the following graph. You must show the detailed steps of applying Dijkstra's algorithm to solve the problem. (20)

