

四川大学期末考试试题（闭卷）

(2024~2025 学年第 1 学期)

A 卷

课程号-课序号: 311076040/01-04,666 课程名称: 数据结构与算法 任课教师:

适用专业年级: 软件工程 等 2023 级 学生人数: 372 印题份数: 380 学号: 姓名:

考生承诺

- 我已认真阅读并知晓《四川大学考场规则》和《四川大学本科学生考试违纪作弊处分规定（修订）》，郑重承诺：
1. 已按要求将考试禁止携带的文具用品或与考试有关的物品放置在指定地点；
 2. 不带手机进入考场；
 3. 考试期间遵守以上两项规定，若有违规行为，同意按照有关条款接受处理。

考生签名:

| 题号 | 一 (30%) | 二 (50%) | 三 (20%) |
|------|---------|---------|---------|
| 得分 | | | |
| 卷面总分 | | 阅卷时间 | |

- 注意事项：1. 请务必本人所在学院、姓名、学号、任课教师姓名等信息准确填写在试题纸和答卷纸上；
2. 请将答案全部填写在答卷纸上，本试题纸上的答案一律不计分；
3. 考试结束，请将试题纸、答卷纸、添卷纸和草稿纸一并交给监考老师。

| | |
|------|----|
| 教师评阅 | 得分 |
| | |

一、单项选择题（本大题共 15 小题，每小题 2 分，共 30 分）

提示：在每小题列出的四个备选项中只有一个符合题目要求的，请将其代码填写在答题纸上。错选、多选或未选均无分。

1. Consider the following C++ code fragment.

```
int frog(n) {
    if(n==0) return 1;
    return (n + frog(n-1)/2); }
```

 what is its asymptotic time complexity? ()
 - A. $\log n$
 - B. n
 - C. $n\log n$
 - D. n^2
2. Given the input order of a stack is 6, 5, 4, 3, 2, 1, () is not the valid output order.
 - A. 5 4 3 6 1 2
 - B. 4 5 3 1 2 6
 - C. 2 3 4 1 5 6
 - D. 3 4 6 5 2 1
3. In order to prevent pseudo-overflow of an array-based queue we could ().
 - A. Define the array enough large
 - B. Dequeue as soon as possible
 - C. Enqueue as soon as possible
 - D. Use circular queue
4. Consider the three “simple” sorting algorithms for arrays: Bubble Sort, Selection Sort, and Insertion Sort. You start with the array [3,4,7,1,2]. After three iterations of the outer loop, you have the array [1,2,3,7,4]. Which algorithm are you running? ()
 - A. InsertionSort
 - B. SelectionSort
 - C. BubbleSort
 - D. All of the above produce that array after three iterations.

注：试题字迹务必清晰，书写工整。

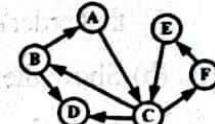
第1页，共4页

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5. If the Binary Tree T2 is transformed from the Tree T1, then the postorder traversal of T1 is the () traversal of T2.

- A. preorder B. inorder C. postorder D. level order
6. As shown in the right graph, start from node B, traverse the nodes on a Depth-First Search (DFS) algorithm, which is the possible traverse sequence? ()

- A. BACDEF B. BADCBE C. BACFDE D. BACDFE



7. Usually, hashing is appropriate for ().

- A. Multiple records are allowed to have the same key value
B. Find all records whose key value is within a certain range
C. Find the record with the largest or smallest key value
D. If it exists, to find the record whose key value is K

8. The most effective way to reduce the time required by a disk-based program is to ().

- A. Improve the basic operations B. Minimize the number of disk accesses
C. Eliminate the recursive calls D. Reduce main memory use

9. What is the minimum number of nodes in a complete binary tree with height 4? ()

- A. 4 B. 6 C. 8 D. 15

10. BST search, insert, and delete operations typically run in time $\Theta(d)$. What is d? ()

- A. The number of entries in each node B. The number of nodes in the tree
C. The depth of the appropriate node in the tree D. The number of divisions at each level

11. Self-organizing lists attempt to keep the list sorted by ().

- A. value B. frequency of record access C. size of record D. none of the above

12. Dijkstra's algorithm requires that vertices be visited in ().

- A. Depth-first order B. Breadth-first order
C. Order of the shortest path distance from the source vertex D. No particular order

13. When comparing the doubly and singly linked list implementations, we find that the doubly linked list implementation ().

- A. Saves time on some operations at the expense of additional space
B. Saves neither time nor space, but is easier to implement
C. Saves neither time nor space, and is also harder to implement
D. Saves time and space together

14. The sorting algorithm used as a model for most external sorting algorithms is ().

- A. insertion sort B. quicksort C. mergesort D. radix sort

15. Consider a recursive mergesort implementation that call insertion Sort on sublists smaller than some threshold. If there are n calls to mergesort, how many calls will there be to insertion Sort? ()

- A. $n-1$ B. n C. $n+1$ D. $2n$

注：试题字迹务必清晰，书写工整。

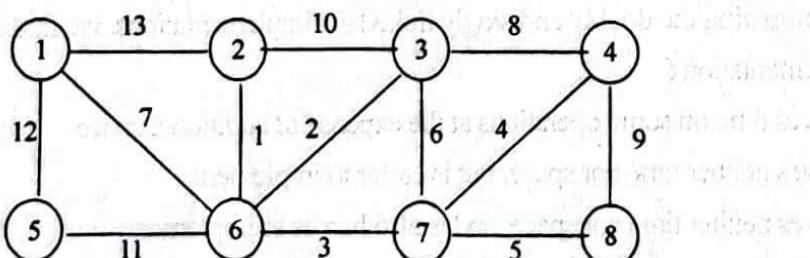
第2页，共4页

试卷编号：311-5

二、应用题（本大题共 5 小题，每小题 10 分，共 50 分）

提示：有求解过程的要尽量给出解题步骤，只有最终答案会酌情扣分。

1. (a) Show the BST that results from inserting the values 25, 12, 30, 52, 18, 36, 12, 19, and 27 (in that order).
 (b) Show the enumerations for the tree of (a) that result from doing an inorder traversal and a postorder traversal.
 (c) Draw the BST that results from deleting the value 25 from the BST of (a).
2. Assume that a certain communication system may involve nine characters: C, O, M, P, U, T, E, R, and S, with their respective weights being 11, 9, 6, 15, 23, 12, 4, 3 and 17.
 (a) Utilize these characters as leaf nodes to construct a Huffman coding tree and devise the corresponding Huffman code for these characters.
 (b) What is the average number of bits required by a character using the Huffman code for this alphabet?
3. Given an array containing the elements {54, 22, 90, 8, 25, 66, 45, 30, 28, 14, 31, 46, 72}. Show the partition result during the first pass of quicksort (please choose the middle position element of the array to be the pivot). Be sure to display the array after each swap.
4. Consider the undirected graph shown below. In what order are edges added to the minimum spanning tree by Kruskal's algorithm? List the edges by giving their endpoints, and compute the cost of the minimum spanning tree.



5. You are given a series of records whose keys are integers. The records are inserted in the following order: 58, 36, 50, 20, 54, 95, 30, 40, 45.
 (a) Show the B+-tree of order 3 that results from inserting these records. A leaf node stores 3 records at most, 2 records at least.
 (b) Show the result of deleting the record with key 58 from the B+-tree of (a).

三、算法题（本大题共 2 小题，每小题 10 分，共 20 分）

提示：每小题给出了一个程序设计要求，请按照要求写出源程序代码，或补全源程序代码，如果源程序代码中出现语法错误或逻辑错误，则酌情扣分。

1. You are given two linked list L, P, and P contain integers sorted in ascending order. The operation PrintLots(L, P) will print the elements in L that are in positions specified by P. For instance, if the data in P is 1, 3, 4, 6, then the first, third, fourth, and sixth elements in L are printed (if there are these elements). Write the printLots function. You can use List ADT functions. For full credit, the running time of your algorithm should be as low as possible.

```
void PrintLots(LLList<double> L, LLList<int> P)
```

2. The following code is a function used to determine whether the parentheses in a string are balanced and properly nested. For example, the string “((0)0)0” contains properly nested pairs of parentheses, but the string “)0(” does not, and the string “0)” does not contain properly matching parentheses. Please fill the code of the function which takes a char array as its parameter. The function returns true if the char array contains properly nested and balanced parentheses, and false otherwise. You can use a stack whose ADT template function shown as below.

```
template <class T> class stack {
public:
    void clear();
    bool push(const T item);
    bool pop(T& item);
    bool topValue(T& item);
    bool isEmpty();
    bool isFull();
};

bool balance(char a[])
{
    stack<char> mystack;
    for(int i=0; ____(1____); i++)
    {
        if(a[i]==')' _____(2____);
        else if(a[i]=='')
        {
            if _____(3____) return false;
            else _____(4____);
        }
    }
    if _____(5____) return true;
}
```