四川大学期末考试试题（闭卷）

（2020~2021 学年第 1 学期）　　A 卷

课程号：311076040 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 2019 级 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 (40%)	三 (20%)	四(10%)
得　　分				
卷面总分		阅卷时间		

注意事项：1. 请务必将本人所在学院、姓名、学号、任课教师姓名等信息准确填写在试题纸和答题纸上；

2. **请将答案全部填写在答题纸上；本试题纸上的答案一律不计分；**

3. 考试结束，请将试题纸、答题纸和草稿纸一并交给监考老师。

评阅教师	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是符合题目要求的，请将其代码填写在答题纸上。错选、多选或未选均无分。

1. Assuming that the initial state of stack S and queue Q is empty, elements e1, e2, e3, e4, e5, and e6 pass through S in turn, and an element enters Q after being popped out of S. If 6 elements are popped out of S, the sequence is e2, e4, e3, e6, e5, e1, the capacity of S should be at least (　).
   A. 2
   B. 3
   C. 4
   D. 5
2. There are 1001 nodes on a complete binary tree, find the number of leaf nodes. (　).
   A. 498
   B. 499
   C. 501
   D. 500
3. The following correct statements about BST include (　).
   A. When the node to be deleted has a left subtree and a right subtree, only the maximum value of the left subtree can be used to replace the node.

B. Given the pre-order and post-order traversal results, the BST cannot be determined.
C. Given a BST, the time complexity required for sorting according to the node value is linear.
D. Given a BST, it can be transformed into a balanced binary search tree within linear time complexity.

4. A group of record keys to be sorted is as follows: 56, 34, 58, 26, 79, 52, 64, 37, 28, 84, 57. ( ) is sort results for the first time of Radix Sort.
A. 84，79，64，37，57，52，58，26，28，34，56
B. 52，34，64，84，56，26，37，57，58，28，79
C. 34，56，26，58，52，64，37，28，79，57，84
D. 34，56，26，58，52，79，37，64，28，84，57

5. The basic operation process of external sort is ( ).
A. Build a tree.
B. Generate initial run.
C. Merge.
D. B and C.

6. A good hash function will ( ).
A. Use the high-order bits of the key value.
B. Use the middle bits of the key value.
C. Make use of all bits in the key value.
D. Use the low-order bits of the key value.

7. To sort a set of data (84, 47, 25, 15, 21), the steps of the data changes during the sorting process as (1) 84 47 25 15 21 ;(2) 15 47 25 84 21 ;(3) 15 21 25 84 47 ;(4) 15 21 25 47 84. The sorting algorithm used is ( ).
A. Selection sort
B. Bubble sort
C. Quicksort
D. Insertion sort

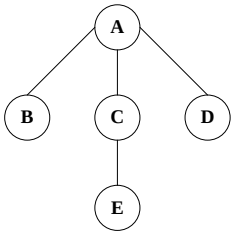
8. The asymptotic cost of inserting and deleting of one record from B-tree trees is ( ).
A. $\Theta(n)$
B. $\Theta(\log n)$
C. $\Theta(n^2)$
D. $\Theta(n\log n)$

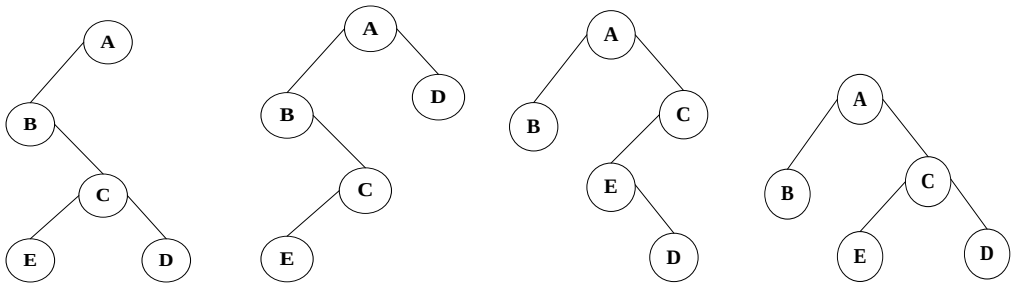
9. Consider the following C++ code fragment.

```
sum = 0;
for (k=1; k<=n; k*=2)
   for (j=1; j<=k; j++)
      sum++;
```

What is its asymptotic time complexity? ( )
A. $\Theta(n\log n)$ B. $\Theta(n)$ C. $\Theta(n^2)$ D. $\Theta(1)$

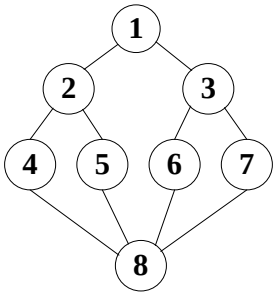
10. If the most common operation of a list is to access any element with a specified sequence number and to perform insertion and deletion operations at the end. (　) is the most efficient data structure.
    A. Doubly linked list　B. Array-based list
    C. Singly linked list　D. Circular linked list
11. Which Binary Tree is reconstructed from the following General Tree (　)





A　B　C　D

12. Assume the postorder of a binary tree T is DABEC, the inorder of T is DEBAC, then the preorder of T is (　).
    A. ACBED　B. DECAB　C. DEABC　D. CEDBA
13. The priority queue is a structure implementing (　) .
    A. inserting item only at the rear of the priority queue.
    B. inserting item only at the front of the priority queue.
    C. deleting item according to the priority of the item.
    D. first in/first out
14. Which is not the property of a B-tree of order m? (　)
    A. The root node has m subtree at most　B. All leaf nodes are at the same level.
    C. The keys in every node are ordered.　D. All leaf nodes are connected by links.
15. For the following graph, one of results of depth-first traversal is (　)



C. 1,2,3,4,5,6,7,8　B. 1,2,4,8,5,3,6,7　C. 1,2,4,8,5,6,3,7　D. 1,2,4,8,5,6,7,3

评阅教师	得分

二、应用题（本大题共 5 小题，每小题 8 分，共 40 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. Given an array containing the elements {100, 11, 78, 9, 81, 8, 26, 97, 82, 40, 44, 45, 1}. Show the partition result during the first pass of quicksort (choosing the middle position element of the array to be the pivot). be sure to display the array before each swap and after each swap.

2. Using closed hashing, with double hashing to resolve collisions, insert the following keys into a hash table of 7 slots (the slots are numbered 0 through 6). The hash function to be used are H1 and H2, defined below.

   H1(k) = k % 7

   H2(k) = (30-k)%6

   Keys: 12 19 21 4 7

   1) Show the final hash table after all the five keys have been inserted, be sure to indicated how you are using H1 and H2 to do the hashing.
   2) After inserting the five keys in 1), List for each empty slot the probability that it will be the next one filled.
   3) Determine the SL(关键字比较次数) when searching 19 in the HT

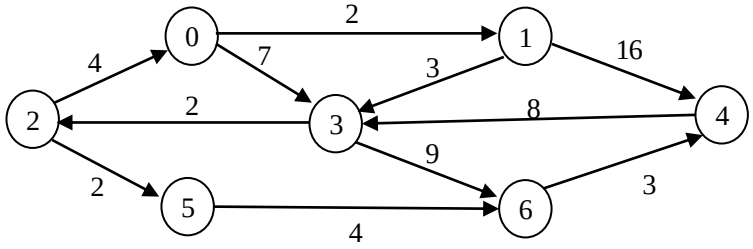
3. You are given a series of records whose keys are integer, the records are inserted in the following order: 132, 56, 39, 8, 2, 35, 10, 64, 9, 20, 18.
   1) Show the B^+-tree of the order four that results from inserting these records. Assume that the leaf nodes are capable of storing up to three records.
   2) Show the result of deleting the values 18 and 2 (in that order) from the B^+-tree of 1)

4. Build the Huffman coding tree and determine the codes for the following set of letters and weights:

Letter	A	B	C	D	E	F	G	H	I	K
Frequency	2	5	6	7	12	20	27	36	39	50

What is the expected length in bits of a message containing 200 characters for this frequency distribution?

5. Show the shortest paths generated by running Dijkstra's shortest-paths algorithm on the following graph, beginning at Vertex 0. Show the D values as each vertex is processed.



评阅教师	得分

三、编程题（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，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. Write a function to determine whether a given binary tree is a binary search tree.
2. Design an algorithm to move all odd numbers before all even numbers in a Sequential List.

评阅教师	得分

四、非标准答案题（本大题共 1 小题，共 10 分）。

提示：根据自己的理解和知识背景，对题目给出分析和阐述。

In a sorting application, you can select an algorithm from three sorting algorithms: insertion sorting, heap sorting, and merge sorting. Please write down the most suitable situations for each of these three algorithms.