四川大学期末考试试题（闭卷）

（2023~2024 学年第 1 学期）　　A 卷

课程号-课序号：**311076040 / 01-06** 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 2022 级** 学生人数：**348** 印题份数：**350** 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。

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. The best case for an algorithm refers to (　　)

   A. The smallest possible input size.

   B. The specific input instance of a given size that gives the greatest cost.

   C. The largest possible input size that meets the required growth rate.

   D. The specific input instance of a given size that gives the lowest cost.

2. Which is the upper bounds for T(n) = T(n/2) + 1，T(1) = 1? (　　)

   A. $O(n^2)$　B. O(nlogn)　C. O(n)　D. O(log n)

3. Which of the following statement about BST is right? (　　)

   A. All nodes stored in the left subtree of a node whose key value is K have key values greater than K.

   B. All nodes stored in the left subtree of a node whose key value is K have key values less than K.

   C. All nodes stored in the right subtree of a node whose key value is K have key values less than or

equal to K.

D. The correct traversal to use on a BST to visit the nodes in sorted order is postorder traversal.

4. A sorting algorithm is stable if it (　　) .

A. works for all inputs

B. always sorts in the same amount of time (within a constant factor) for a given input size

C. does not change the relative ordering of records with identical key values

D. none of the above

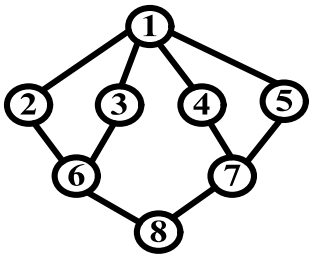
5. The smallest number of keys that will force a B-tree of order 5 to have a height 2 is (　　).

A. 5　　B. 7　　C. 8　　D. 14

6. Let F be a forest composed of three trees: T1, T2 and T3. The node numbers of T1, T2 and T3 are N1, N2 and N3 respectively. Converting F to a single binary tree B. The node number of the right subtree of the root node of B is (　　).

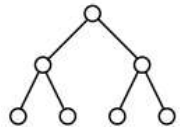
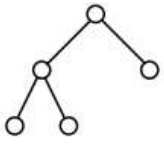
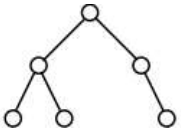
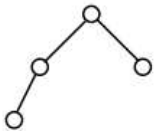
A. N1-1　　B. N2-1　　C. N2+N3　　D. N1+N3

7. As shown in the below graph, start from node 1, traverse the nodes on a Depth-First Search(DFS) algorithm, which is the possible traverse sequence? (　　)



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

8. (　　) is not the complete Binary Tree in the following 4 Binary Trees.

A. 
B. 
C. 
D. 

9. In the hashing, collision refers to (　　)

A. The keys are mapped to an address that is out of range of hash table.

B. Different keys are mapped to the same address of hash table.

C. Two records have the same key.

D. Data elements are too much.

10. Using the parent pointer representation for general trees can solve which problem? (　　)

A. Shortest paths　B. General tree traversal　C. Equivalence classes　D. Exact-match query

11. Breadth-first search in graph is best implemented using (　　).

A. A stack or recursion　　B. A queue　　C. A tree　　D. none of the above

12. Suppose that a client performs an intermixed sequence of push and pop operations. The push operations push the integers 0 through 9 in order into the stack; the pop operations print out the return value. Which sequence could not occur? (　　)

A. 4 3 2 1 0 9 8 7 6 5　B. 0 4 6 5 3 8 1 7 2 9　C. 2 1 4 3 6 5 8 7 9 0　D. 4 6 8 7 5 3 2 9 1 0

13. Push a node which is pointed by the pointer p into a linked stack whose top pointer is top, then execute statements are (　).

A. p->next = top->next; top->next = p;

B. p->next = top;　top = p;

C. top->next = p;

D. p->next = top, top = top->next;

14. The basic unit of I/O when accessing a disk drive is (　　)

A. A byte　B. A sector　C. A cluster　D. A track

15. Sort the sequence (84, 47, 56, 15, 21) and the intermediate result of 2nd pass is: (15, 21, 56, 84, 47), then the sort method used is (　　) .

A. Selection Sort　B. Bubble Sort　C. Quick Sort　D. Insertion Sort

评阅教师	得分

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. Assume that you have a 17 slots closed hash table. If you used the hash function h(k) = k % 17 and linear probing, here the linear probing sequence d_i will be: 1, 3, 5, 7, 9 …
   a) Show the final hash table after inserting the number sequence: 64, 91, 75, 31, 41, 13, 22, 9, 83, 23, 53, 11.
   b) Determine the ASL(平均关键字比较次数) when searching sequence 64, 91, 75, 31, 41, 13, 22, 9, 83, 23, 53, 11 in the hash table
   c) Briefly answer the advantages of hash tables as a data structure in search operations.
2. Given the list of keys: 3，87，12，61，70，97，26，45. Using heap sorting to sort the keys in ascending order, fill in the missing results of each step shown below.
   a) Build the heap: _____
   b) Each step of the sorting process:
   （1）87 70 26 61 45 12 3 97;　（2）_____;
   （3）61 45 26 3 12 70 87 97;　（4）_____;

（5）26 12 3 45 61 70 87 97;　（6）_____;

（7）3 12 26 45 61 70 87 97;

c) Analyze the time complexity of the algorithm.

3. Give out the queue-based topologic sort result of the graph shown in Figure 1. Be sure to display the Queue after each Enqueue and Dequeue.

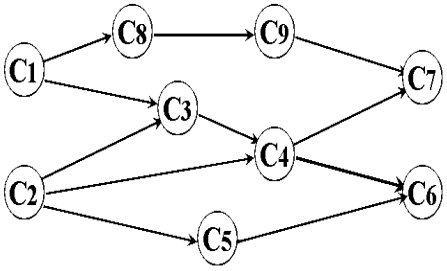


Figure 1(二、3 题)

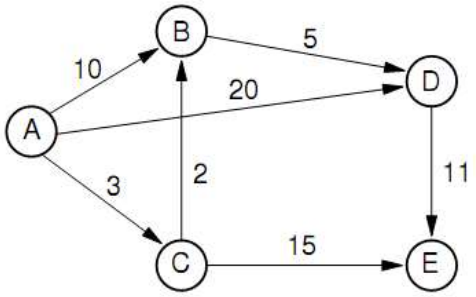


Figure 2(二、4 题)

4. Show the shortest paths generated by running Dijkstra's shortest-paths algorithm on the graph shown in Figure 2, beginning at Vertex A. Show the D values as each vertex is processed.

5. Add 62 and 65 to the 2-3 tree shown in Figure 3.

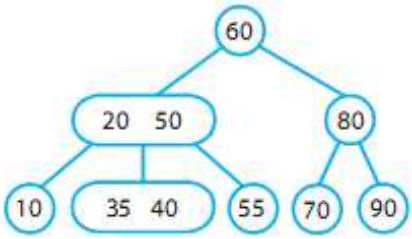


Figure 3(二、5 题)

评阅教师	得分

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，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 that implements Insertion Sort for the case where the input is a singly linked list.

2. Write a function that returns the second largest value in a binary search tree containing at least two nodes.