四川大学期末考试试题（闭卷）

（2019~2020 学年第 1 学期）　　B 卷

课程号：311076040　课程名称：数据结构与算法　任课教师：孙界平/张卫华/李晓华/杨秋辉

适用专业年级：软件工程 2018 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			教师签名		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添卷纸上；

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，请将其代码写在答题纸上。错选、多选或未选均无分。

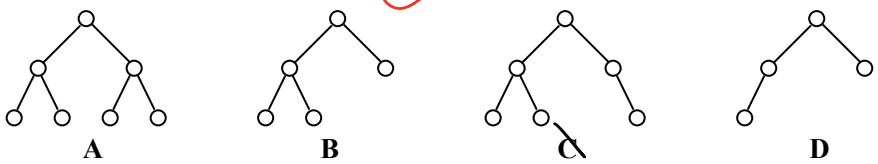
1. Which of the following data structures uses a "Last-in, First-out" policy for element insertion and removal? (A)
   A. Stack
   B. Tree
   C. Hash table
   D. Queue
2. If deleting the *i*th key from a contiguous list with n keys, (A) keys need to be shifted left one position.
   A. n-i
   B. n-i+1
   C. i
   D. n-i-1
3. In the hash function, collision refers to (B)
   A. Two elements have the same sequence number.
   B. Different keys are mapped to the same address of hash table.

注：1、印制试卷时同时提交《四川大学期末试卷审批表》。
2、本试卷审批表同试卷一并归档保存。

C. Two records have the same key.

D. Data elements are too much.

4. In the following four Binary Trees, (C) is not a complete Binary Tree.

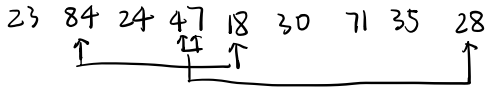


5. Sorting a key sequence（28，84，24，47，18，30，71，35，23）, its status is changed as follows.

23，18，24，28，47，30，71，35，84

18，23，24，28，35，30，47，71，84

18，23，24，28，30，35，47，71，84



The sorting method is called (D)

A. select sorting

B. Shell sorting

C. merge sorting

D. quick sorting

6. Assume a sequence list as 1,2,3,4,5,6 passes a stack, an impossible output sequence list is (C).

A. 2,4,3,5,1,6

B. 3,2,5,6,4,1

C. 1,5,4,6,2,3

D. 4,5,3,6,2,1

7. In the following sorting methods, the time complexity of (D) is irrelative with the initial order of sequence.

A. Insertion sort

B. Bubble sort

C. Quick sort

D. Selection sort

8. Which linear list is better to get the elements for a given index and insert or delete in the last location? (C)

A. doubly circularly linked list

B. doubly linked list

C. array

D. singly circularly linked list

9. There is an algorithm with inserting an item to an ordered Array-based List and still keeping the Array-based List ordered. The computational efficiency of this inserting algorithm is (C).

A. $\Theta(\log_2 n)$

B. $\Theta(1)$

C. $\Theta(n)$

D. $\Theta(n^2)$

10. Self-organizing lists attempt to keep the list sorted by: (B)

A. Value

B. frequency of record access

C. size of record

D. None of the above

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

A. Improve the basic operations.

B. Minimize the number of disk accesses.

C. Eliminate the recursive calls.

D. Reduce main memory use.

12. To avoid so many recursive calls in quicksort, the best idea is to (B)

A. Have a single recursive call in the code.

B. Stop before the slices get too small and use an insertion sort at the end.

C. Have a base case which can handle slices of size five or less.

D. Use one pass of shell sort before calling the quick sort.

13. Which statement is not correct among the following four: (A)

A. The worst case for my algorithm is n becoming larger and larger because that is the slowest.

B. A cluster is the smallest unit of allocation for a file, so all files occupy a multiple of the cluster size.

C. The selection sort is an unstable sorting algorithm.

D. The number of leaves in a non-empty full binary tree is one more than the number of internal node.

14. The time cost of Quicksort in the worst case is (D)

A. O(n)

B. $O(\log_2 n)$

C. $O(n \log_2 n)$

D. $O(n^2)$

15. In an undirected graph with n vertices, the maximum number of edges is (B).

A. n(n+1)/2

B. n(n-1)/2

C. n(n-1)

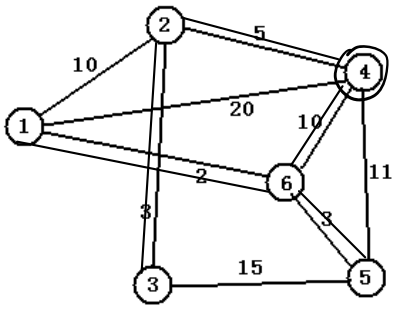
D.　n^2

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. List the order in which the edges of the graph in following Figure are visited when running Prim's MST algorithm starting at Vertex 4.　Show the final MST.



V_4-V_2、V_2-V_3、V_4-V_6、V_1-V_6、V_6-V_5

如右图所示

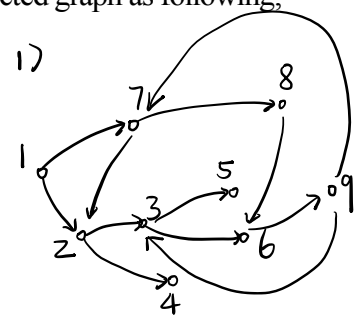
2. Given the Adjacency Matrix representation of a directed graph as following,

1) Draw the graph.

2) Represent the graph using Adjacency List.

	1	2	3	4	5	6	7	8	9
1	0	1	0	0	0	0	1	0	0
2	0	0	1	1	0	0	0	0	0
3	0	0	0	0	1	1	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	1
7	0	1	0	0	0	0	0	1	0
8	0	0	0	0	0	1	0	0	0
9	0	0	1	0	0	0	1	0	0

1)



2)略。

3. Show the result of inserting {48, 35, 64, 92, 77, 13, 29, 44} into an initially empty complete Binary Tree. If sorting the list in ascending order, then please justify the complete Binary Tree into heap, and draw the heap after finishing one pass heapsort process.

4. Given Hash function H(K)=(3*K) mod 11 and the key sequence(13, 49, 24, 38, 32, 21, 4, 12). The size of hash table is 11.

(a)　Construct the hash table with linear probing method.

(b)　Calculate the average search length for successful and unsuccessful search under the equal probability.

6 4 6 4 8 8 1 3

7 5 9

(a)

0	1	2	3	4	5	6	7	8	9	10
	4		12	49	38	13	24	32	21	

(b) $ASL=\frac{1}{8}(1+1+2+2+1+2+1+1)=1.375$

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

a	b	c	d	e	f	g	h	i	j	k	l
2	3	5	7	11	13	17	19	23	31	37	41

What is the average code length?

评阅教师	得分

三、编程、设计及分析题（本大题共 2 小题，1 小题 8 分，2 小题 12 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。

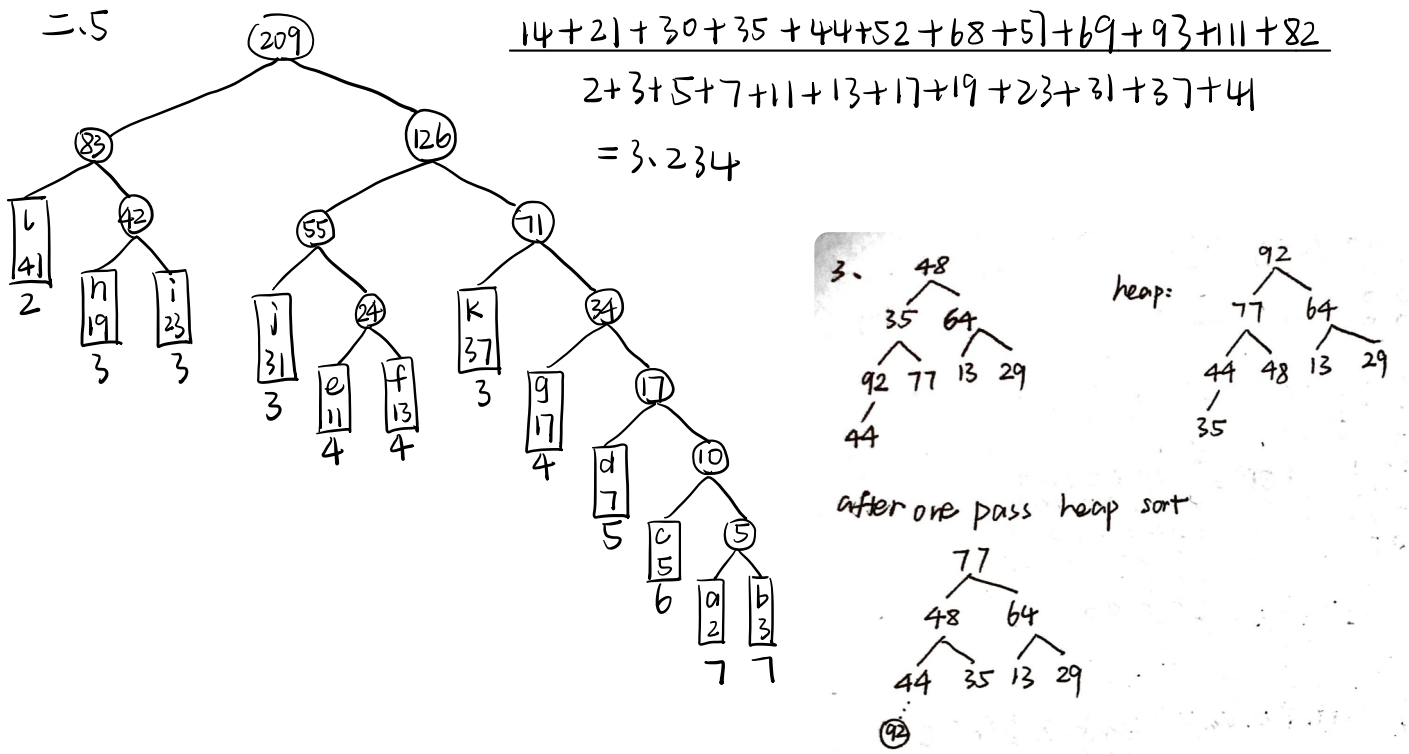
1. A directed graph is represented with an adjacency list. Write a function to calculate the in-degree of each vertex.
2. Key sequence ($k_1, k_2, \ldots, k_{n-1}$) is a heap, design an algorithm to adjust the sequence ($k_1, k_2, \ldots, k_{n-1}$, x) to a heap.

评阅教师	得分

四、分析题（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。

Devise a method to sort seven numbers. The method may make as few KCN as possible, or make as few RSN as possible, or make as few memory requirement as possible. Be sure to indicate how many *** are required in the best, worst and average cases for the method you devised



1、
```
void InDegree(Graph*G, int*inDegree){
    int v, w;
    for(v=0; v<G->n(); v++) inDegree[v]=0;
    for(v=0; v<G->n(); v++)
        for(w=G->first(v); w<G->n(); w=G->next(v,w))
            inDegree[w]++;
}
```

2、
```
int parent(int pos) const {return (pos-1)/2;}
void toHeap(Elem A[], int n){
    int curr=n-1; //将第n个插入,数组下标为n-1.
    while(Elem[curr]>Elem[parent(curr)]){
        Elem Temp=Elem[curr];
        Elem[curr]=Elem[parent(curr)];
        Elem[parent(curr)]=Temp;
        curr=parent(curr);
    }
}
```
交换

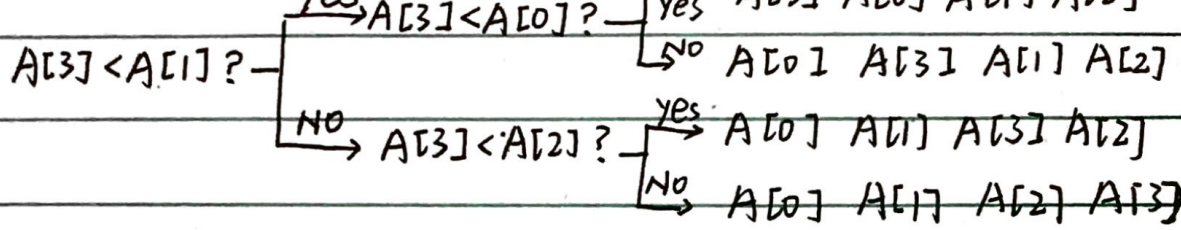
四、1、设7个待排数据为A[7]

Step1：先用if语句将A[0]~A[2]3个数排好

	Best	Worst	Aver
交换	0	2	1
比较	2	3	2.5

	best	over	worst
比较	2	2.5	3
交换	0	1	2

Step 2. 将A[3]插入前3个有序表中（A[0]、A[1]、A[2]已有序）



	best	aver	worst
比较	2	2	2
交换	0	1.5	3

Step 3. 同step2，将A[4]插入前4个有序表中

先用i与中间数比较，再与两边比较，确定最终顺序

	best	aver	worst
比较	2	2.5	3
交换	0	2	4

Step 4. 将A[5]插入

	best	aver	worst
比较	2	2.5	3
交换	0	2.5	5

Step 5. 将A[6]插入

	best	aver	worst
比较	2	3	4
交换	0	3	6

综上，整个算法KCN与RSN为如下，此时两者最小。

	best	aver	worst
比较	2	8.5	15
交换	0	10	20