浙江大学宁波理工学院 2018–2019 学年 1 学期

《数据结构(A)》课程期末考试试卷（A）

开课分院：数据与计算机工程学院，考试形式：闭 卷，允许带_____入场

考试日期：2019 年 1 月 16 日，考试所需时间：120 分钟

考生姓名_____学号_____考生所在分院：数据学院 专业班级：_____.

术语表：

binary search tree 二叉搜索树	balance factor 平衡因子	complete binary tree 完全二叉树
sorted (non-decreasing) order （非递减）有序	（worst-case） time complexity（最坏情况）时间复杂度	single source shortest path 单源最短路径
preorder traversal 先序遍历	binary tree 二叉树	topological order 拓扑排序
inorder traversal 中序遍历	dummy head node 空表头结点	weighted path length 带权路径长度
postorder traversal 后续遍历	linear list 线性表	linear probe 线性探测
Singly/ doubly linked list 单/双向链表	ascending 递增	quadratic probe 平方探测
Circular Queue 循环队列	postfix expression 后缀表达式	Open addressing 开放定址
circularly linked list 循环链表	Shell/Heap/Quick/Insertion/Merge/bubble sort 希尔/堆/快速/插入/归并/冒泡排序	collision 冲突
circular array 循环数组	average search time 平均查找时间	loading factor 负载因子
hash table 散列表	adjacency matrix 邻接矩阵	sequence 序列
hash value 散列值	DFS/BFS 深度/宽度优先搜索	connected component 连通部件
adjacency lists 邻接表	connected graph 连通图	

命题（组）老师签名：_____ 年 月 日

分院主管教学院长或首席主讲教授签名：_____ 年 月 日

1、Answer the following questions with True or False, and make it on your answer sheet.（15 Points）

(　　)1、　*NlogN* and $NlogN^2$ have the same speed of growth.

(　　)2、　For any node in an AVL tree, the height of the left subtree must be greater than that of the right subtree.

(　　)3、　The algorithm is independent of the specific programming language and independent of the specific computer.

(　　)4、　In a single linked list with N nodes, the time complexity of accessing nodes and adding nodes are O(1) and O(N), respectively.

(　　)5、　Run the following operations on a stack S: Push(S,a), Push(S,b), Pop(S), Push(S,c), Pop(S), Pop(S). The output sequence must be {a, b, c}.

(　　)6、　A queue is a linear list with insert and delete operations at both ends of the list. It's a First in Last out list.

(　　)7、　In hashing, functions "insert" and "find" have the same time complexity.

(　　)8、　In a graph G, if we have to do DFS twice to visit every one of its vertices, then there must be two connected components in G.

(　　)9、　In a binary search tree, the keys on the same level from left to right must be in sorted (non-decreasing) order.

(　　)10、　To sort *N* records by heap sort, the extra space taken is O(*N*).

(　　)11、　If the preorder and inorder traversal sequences of a binary tree are the same, then none of the nodes in the tree has a left child.

(　　)12、　If A and B are both leaf nodes in a binary tree, then there exists a binary tree with preorder traversal sequence ...A...B... and inorder traversal sequence ...B...A....

(　　)13、　To find 63 from a binary search tree, one possible searching sequence is {39, 125, 101, 80, 70, 59, 63}.

(　　)14、　In a hash table, "synonyms"(同义词) means two elements sharing the same hash value.

(　　)15、　If a graph is represented by an adjacency matrix, then the space taken depends only on the number of vertices, not the number of edges.

2. Read each of the following questions carefully; choose the best answer(from among items A, B, C, or D) and make it on your answer sheet.（30 Points）

(　　)1、 In a singly linked list, if the node pointed by p is not the last node, then to insert a node pointed by s after p, we must do:

A. s->next=p; p->next=s;　　B. s->next=p->next; p=s;

C. s->next=p->next; p->next=s;　　D. p->next=s; s->next=p;

(　　)2、 Suppose that an array of size 6 is used to store a circular queue, and the values of front and rear are 0 and 4, respectively. Now after 2 dequeues and 3 enqueues, what will the values of front and rear be?

A. 2 and 1　　B．2 and 3

C. 2 and 4　　D. 2 and 5

(　　)3、 To merge two singly linked ascending lists, both with *N* nodes, into one singly linked ascending list, the minimum possible number of comparisons is:

A．1;　　B．*N*

C. 2*N*　　D. *NlogN*

(　　)4、 Let P stands for push and O for pop. When using a stack to calculate the value of the postfix expression 1 2 3 + * 4 －, the stack operation sequence is:

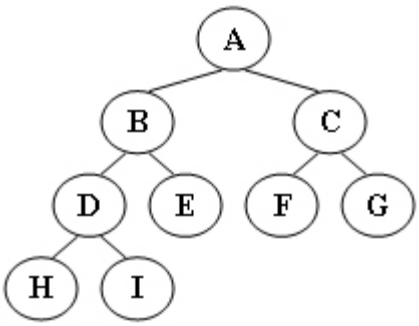
A. PPPOOPOO

B. PPOOPPOOPPOO

C. PPPOOPOOPPOO

D. PPPOOPOOPPOOPO

(　　)5、 Given a binary tree as shown in the figure. Its preorder traversal sequence is:



A. A, B, C, D, H, E, I, F, G

B. A, B, D, H, I, E, C, F, G

C. H, D, I, B, E, A, F, C, G

D. H, I, D, B, E, F, G, A, C

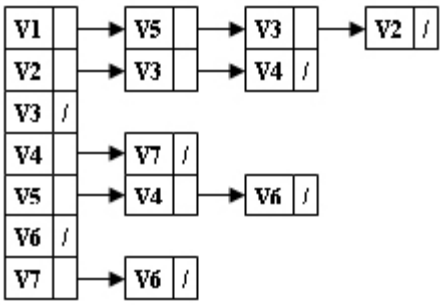
(　　)6、 On the 5th level of a binary tree (the root is at the 1st level), we can have at most（　）nodes.

A. 8　　B. 15　　C. 16　　D. 32

(　　)7、 Insert {7, 5, 2, 3, 8, 18} one by one into an initially empty max-heap. The root of the resulting heap is:

A. 3　　B. 5　　C. 7　　D. 18

(　　)8、 Given the adjacency lists of a directed graph as shown by the figure. Then starting from V1, a possible DFS sequence is:



A. V1,V5,V4,V7,V6,V2,V3

B. V1,V2,V3,V4,V7,V6,V5

C. V1,V5,V4,V7,V6,V3,V2

D. V1,V5,V6,V4,V7,V2,V3

(　　)9、 Given input {15, 9, 7, 8, 20, -1, 4}. If the result of the 1st run of Shell sort is {15, -1, 4, 8, 20, 9, 7}, then the initial increment must be:

A. 1　　B. 2

C. 3　　D. 4

(　)10、To sort data files of size 10TB, the proper method is:

A. merge sort　B. heap sort　C. Shell sort　D. quick sort

(　　)11、Construct a Huffman tree from four leaf nodes with weights 9, 2, 5 and 7. Then the weighted path length of this Huffman tree is:

A. 23　B. 37　C. 44　　D. 46

(　　) 12. For a singly linked list of N nodes, the time complexity of inserting a new node after the node with key value *x* is:

A. O(1)　　B. O(N/2)　　C. O(N)　　D. $O(N^2)$

(　　)13、 Which one of the following statements is TRUE about the consequential addresses generated by linear probing to resolve collisions?

A. They must be greater than or equal to the original has address

B. They must be smaller than or equal to the original has address

C. They can be greater than or smaller than, but never equal to the original has address

D. There is no restriction on the addresses

( )14、Given a binary tree with 100 leaves and without 1-degree nodes, the number of nodes in the tree is __ .

A. 100　　B. 102　　C. 199　　D. 200

( )15、The routes of airline flights can be represented by a directed graph. Which one of the following algorithms is the most suitable for finding the most economical flight path between any pair of cities?

A. Dijkstra　B. Kruskal　C. DFS　D. Topological sort

3. Read each of the following programs (originate from the textbook) carefully, fill in the blanks and make it on your answer sheet. (2 points for each blank, 20 points total)

1）Given the following function for Hanoi Tower Problem:

```
void Move( int n, int start, int goal, in temp){
        if( n>=1){
                ________(1)________;
                printf( “Move  disk %d from %d to %d.\n”, n, start, goal);
                ________(2)________;
        }
}
```

2）Given the following program to initialize a array implementation stack.

```
typedef int Position;
typedef struct SNode *PtrToSNode;
struct SNode{
        ElementType *Data;
        Position Top;
        int MaxSize;
};
typedef PtrToSNode Stack;
Stack CreateStack( int MaxSize){
        ___________(3)___________;
        ___________(4)___________;
        S->Top =  -1;
```

```
        S-MaxSize =  MaxSize;
        return S;
}
```

3）Given the following program for level order traversal of a binary tree.

```
void LevelorderTaversal( BinTree BT){
        Queue Q;
        BinTree T;
        if(!BT)  retrun;
        Q = CreateQueue();
        AddQ( Q, BT);
        while( !Isempty(Q)){
                T = DeleteQ(Q);
                printf("%d", T->Data);
                _____(5)_____;
                _____(6)_____;
        }
}
```

4) Given the following program for the Simple Insertion Sort.

```
void InsertionSort( ElementType A[], int N){
        int P, i;
        ElementType Tmp;
        for( P=1; P<N; P++){
                Tmp = A[P];
                for( i=P; _____(7)_____; i--)
                        _____(8)_____;
                A[i] = Tmp;
        }
}
```

5) Given following program for inserting an element into a MaxHeap:

```
bool Insert( MaxHeap H, ElementType X){
        int i;
        if( IsFull(H)){
```

```
            printf("MaxHeap is full.");
            return false;
        }
        i = ++H->Size;
        for( ; H->Data[i/2]; i/=2)
            _____(9)_____;
        _____(10)_____;
        return true;
}
```

4. Please write or draw your answers for the following problems on the answer sheet. (35 points)

1) (7 points) The following post-expression: A B + C * D – E /, please construct the expression tree and draw the content of the Stack while reading C and E.

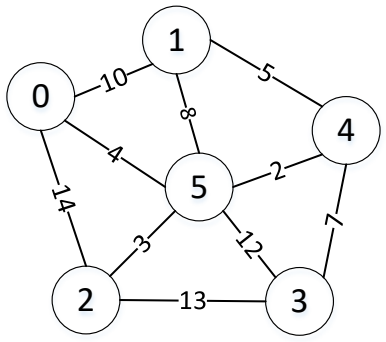
2) (7 points) For a sequence of key{ 48, 27, 22, 30, 55, 35, 20, 96, 75}, please construct the AVL tree, write the solutions while reading 35 and 75.

3) (7 points) Assume keys={35, 10, 12, 1, 20, 27, 18, 33, 24, 19, 49}, Hash function is h(key)=key%11. The separate chaining is used to resolve collisions. Please draw the final open hash table, and calculate the ASL(Average Search Length) of the hash table.

4) (7 points) For the following weighted undirected graph:

a) What is the Adjacency Lists?

b) Calculate the minimum spanning tree by Prim's algorithm from vertex 0.



5)(7 points) For the following sequence, please sort it into decreasing sequence by Quick Sort algorithm. Write the sequence after first and second order sorting operation.

2, 131, 81, 92, 43, 41, 65, 257, 26, 314, 30, 58, 75, 100, 70