浙江大学宁波理工学院 2017–2018 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：2018 年 1 月 23 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	quick sort 快速排序
quadratic probing 平方探测法	AOV Activity On Vertex 活动图
preorder traversal 先序遍历	binary tree 二叉树
inorder traversal 中序遍历	dummy head node 空表头结点
singly linked list 单向链表	linear list 线性表
time complexities 时间复杂度	linked list 链表
Circular Queue 循环队列	postfix expression 后缀表达式
circularly linked list 循环链表	complete binary tree 完全二叉树
circular array 循环数组	average search time 平均查找时间
hash table 散列表	adjacency matrix 邻接矩阵
hash value 散列值	BFS 宽度优先搜索
adjacency lists 邻接表	Huffman code 哈夫曼编码
connected graph 连通图	Heap sort 堆排序
topological ordering 拓扑排序	separate chaining 分离链接法

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. The major task of algorithm analysis is to analyze the time complexity and the space complexity.

(   ) 2. N^2logN and Nlog N^2 have the same speed of growth.

(   ) 3. In a singly linked list of N nodes, the time complexities for query and insertion are O(1) and O(N), respectively.

(   ) 4. If the most commonly used operations are to visit a random position and to insert and delete the last element in a linear list, then sequential storage works the fastest.

(   ) 5. If keys are pushed onto a stack in the order {a, b, c, d, e}, then it is impossible to obtain the output sequence {c, d, a, b, e}.

(   ) 6. If the postorder and inorder traversal sequences of a binary tree are the same, then none of the nodes in the tree has a right child.

(   ) 7. The time complexity of searching in a binary search tree is the same as that of binary search.

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

(   ) 9. If the depth of an AVL tree with nodes { 1, 2, 3, 4, 5 } is 3 (the depth of the root is 1), then node 3 must have two children.

(   ) 10. If a graph is represented by adjacency lists, then the space taken depends only on the number of vertices, not the number of edges.

(   ) 11. In a connected graph, there exists at least one vertex of which the degree is 1.

(   ) 12. In a graph G, if we have to do BFS twice to visit every one of its vertices, then there must be a cycle in G.

(   ) 13. In a connected graph, the number of edges must be greater than the number of vertices minus 1.

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

(   ) 15. Given a hash table with size 13. If only the positions with odd (奇数) indices are occupied (the index starts from 0), then when the quadratic probing is used, insertion of a new key into this hash table can be successful.

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. Given a 2-dimensional array A of size N×N. The time complexity for finding the largest entry without changing the array is:

A. $O(N^2)$　B. $O(NlogN)$　C. O(N)　D. $O(N^2logN)$

(   ) 2. 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. $O(N^2)$

(   ) 3. To delete a node from a linked stack with ST being its top pointer, and save the key value of the deleted node into X, we must do:

A. X= ST->data　B. X= ST; ST = ST->next

C. X= ST->data; ST = ST->next　D. ST = ST->next; X= ST->data

(   ) 4. When is the linked list structure suitable for representing a linear list L?

A. frequently insert into and delete from L

B. frequently change the key values of the nodes in L

C. L contains large amount of nodes

D. the structure of the nodes in L is complicated

(   ) 5. Given an empty stack S and an empty queue Q. Push elements {1, 2, 3, 4, 5, 6, 7} one by one onto S. If each element that is popped from S is enqueued onto Q immediately, and if the dequeue sequence is {3, 2, 6, 5, 7, 4, 1}, then the minimum size of S must be:

A. 2　B. 3　C. 4　D. 5

(   ) 6. 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

(   ) 7. For a binary tree, given the preorder traversal sequence 12345 and the postorder traversal sequence 32541, the corresponding inorder traversal sequence must be:

A. 23145　B. 23154

C. 24135　D. cannot be determined

(   ) 8. Insert {34, 76, 45, 18, 26, 54, 92, 65} one by one into an initially empty binary search tree. The number of nodes on the last two levels of the resulting tree is:

A. 1　B. 2　C. 3　D. 4

(   ) 9. Insert 2, 1, 4, 5, 9, 3, 6, 7 into an initially empty AVL tree. Which one of the following statements is FALSE?

A. 4 is the root

B. 3 and 7 are siblings

C. 2 and 6 are siblings

D. 9 is the parent of 7

(　　　) 10. Which of the following sequence corresponds to a heap?

A. 37, 99, 45, 33, 66, 10, 22, 13

B. 99, 45, 66, 13, 37, 10, 22, 33

C. 99, 66, 45, 33, 37, 10, 22, 13

D. 99, 66, 22, 33, 37, 13, 45, 10

(　　　) 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. 44　　　　C. 37　　　　D. 46

(　　　) 12. Given the adjacency matrix of a graph as shown by the figure. Then starting from V1, a possible DFS sequence is:

$$\begin{bmatrix} 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

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

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

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

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

(　　　) 13. What kind of problems can Dijkstra algorithm solve?

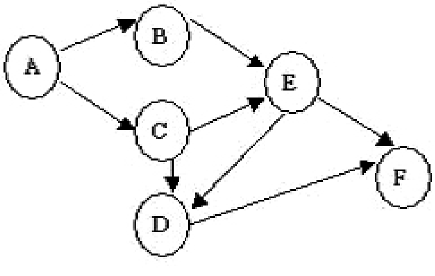
A. critical path

B. shortest path

C. topological sort

D. string matching

(　　　) 14. The figure shows an AOV network. Which one of the following is a possible topological order of the network?



A. ACBDEF

B. ABCEFD

C. ABCDFE

D. ABCEDF

(   ) 15. Given input {46, 79, 56, 38, 40, 84}. After the first partition (with the left most record as the pivot) of quick sort, the resulting sequence is:

A. {38,46,79,56,40,84}

B. {38,79,56,46,40,84}

C. {38,46,56,79,40,84}

D. {40,38,46,56,79,84}

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 to initialize a sequentially stored linear list and find an element.

```
typedef int Position;
typedef struct LNode * PtrToLNode;
struct LNode {
        ElementType Data[MAXSIZE];      /* MAXSIZE 为下标，从 0 开始，足够大的整数*/
        Position Last;
};
typedef PtrToLNode List;
List MakeEmpty()
{
        List L;
        L = (List)malloc(sizeof(___①___));
        L->Last = -1;
        return L;
}
Position Find(List L, ElementType X)
{
        Position i = 0;
        while(i <= L->Last &&___②___!=X){
                i++;
        }
        if(i > L->Last)
        return -1;
    else
        return i;
}
```

2. Given the following function to push an element into stack.

```
typedef int Position;
typedef struct SNode * PtrToSNode;
struct SNode {
    ElementType * Data;          /*存储元素的数组，Data[MaxSize]下标从 0 开始*/
    Position Top;                /*栈顶指针*/
    int MaxSize;                 /*堆栈最大容量*/
};
typedef PtrToSNode Stack;
bool IsFull(Stack S)
{
    return (S->Top ==____③____ );
}
bool Push(Stack S, ElementType X)
{
    if(IsFull(S)){
        printf("Stack is full!");
        return false;
    }else{
        S->Data[____④____] = X;
        return true;
    }
}
```

3. Given the following program to implement inorder traversal sequences of a binary tree.

```
typedef struct TNode * Position;
typedef Position BinTree;
struct TNode {
    ElementType  Data;           /*节点数据*/
    BinTree Left;
    BinTree Right;
};
void InorderTraversal(BinTree BT)
```

```
{
        if(BT){
                InorderTraversal(____⑤____);
                printf(“%d”, BT->Data);
                InorderTraversal(____⑥____);
        }
}
```

4. Given the following program to resolve conflict using quadratic probing.

```
typedef int Position;
Position Find(HashTable H, ElementType Key){
        Position CurrentPos, NewPos;
        int CNum = 0;
        NewPos = CurrentPos = Hash(Key, H->TableSize);
        While(H->Cells[NewPos].Info != Empty && H->Cells[NewPos].Data != Key){
                If(++Cum%2){
                        NewPos = CurrentPos +____⑦____;
                        If(NewPos >= H->TableSize)
                                NewPos = NewPos% H->TableSize;
                }else{
                        NewPos = CurrentPos -____⑧____;
                        While(NewPos<0)
                                NewPos += NewPos% H->TableSize;
                }
        }
        Return NewPos;
}
```

5. Given the following program to implement bubble sort.

```
void BubbleSort(ElementType A[], int N){
        int P,  i;
        bool flag;
        for(P = N-1; P>=0; P--){
                flag = false;
                for(i=0; i<P; i++){
                        if(A[i] > A[i+1]){
                                Swap(____⑨____);
                                flag = true;
```

```
                    }
                }
                if(flag==false) ____⑩____ ;
            }
}
```

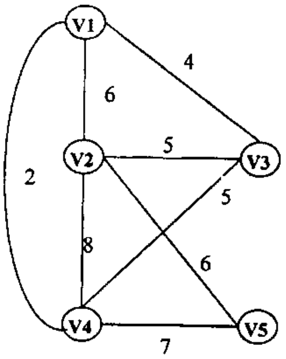
4. Please write or draw your answers for the following problems on the answer sheet. (35 points)

1. (7 points) Given a binary tree, the postorder traversal sequence is: EGFACIJHBD, and the inorder traversal sequence is: EAFGDCBIHJ, please draw the binary tree, and write the preorder traversal sequence.

2. (7 points) The following infix-expression: (A+B)*C-D/E, please write the postfix-expression and draw the content of the Stack while output C and E.

3. (7 points) Assume the character set used in the communication message is{a,b,c,d,e,f}, the frequency of each character in the message is {34, 5, 12, 23, 8, 18}, please try to design Huffman code for these 6 characters, draw the Huffman tree you have construct, write the corresponding code for each character.

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



Calculate the minimum spanning tree by Prim’s algorithm from vertex 1, please draw a construction process step by step while each vertex is added.

5. (7 points) Assume keys={47, 7, 29, 11, 16, 92, 22, 8, 3, 50, 37, 89, 94, 21}, hash function is h(key)=key%11. The separate chaining is used to resolve collisions. Please try to give the final hash table and calculate the average successful search length (ASL).