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（X）

开课分院：数据与计算机工程学院 ，考试形式：闭 卷

考试日期：2018 年 1 月 xx 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. Time complexity of merging two linked list with length m and n is O(m+n).

( ) 2. In any cases,algorithms with time complexity $O(N^2)$ spend more time than $O(N*logN)$.

( ) 3. If N numbers are stored in a singly linked list in increasing order, then the average time complexity for binary search is O(logN).

( ) 4. Given two sorted lists L1 and L2, the fastest algorithm for computing $L1 \cup L2$ has time complexity $\Theta(N^2)$.

( ) 5. Run the following operations on a stack S: Push(S,1), Push(S,2), Pop(S), Push(S,3), Pop(S), Pop(S). The output sequence must be {1, 2, 3}.

( ) 6. Given the input sequence onto a stack as {1, 2, 3, ..., N}. If the first output is i, then the j-th output must be $j-i-1$.

( ) 7. Circular Queue" is defined to be a queue implemented by a circularly linked list or a circular array.

( ) 8. In a min-heap, all the keys along the path from the root to any leaf node must be in sorted (non-decreasing) order.

( ) 9. In a binary search tree which contains several integer keys including 4, 5, and 6, if 4 and 6 are on the same level, then 5 must be their parent.

( ) 10. The sum of the degrees of all the vertices in a connected graph must be an even number.

( ) 11. In a directed graph, the sum of the in-degrees must be equal to the sum of the out-degrees of all the vertices.

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

( ) 13. For any node in an AVL tree, the left and right subtrees must have the same height.

( ) 14. The best "worst-case time complexity" for any algorithm that sorts by comparisons only must be O(NlogN).

( ) 15. Shell sort is stable.

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. Which of the following functions has the fastest growth:

A. $N^2\log N$ B. $N(\log N)^4$ C. N^3 D. $N\log N^2$

( ) 2. Given a 3-dimensional array A of size N×N×N. The time complexity for finding the smallest entry without changing the array is:

A. $O(N^2)$ B. $O(N\log N)$ C. $O(N^3\log N)$ D. $O(N^3)$

( ) 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?

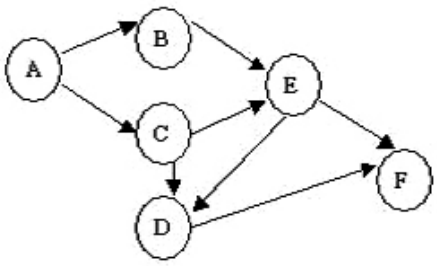
A. critical path

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 a new element into a linear list.

```
void Insert( ElementType X, int i, List    L )
{          int j;
           if ( PtrL->Last == MAXSIZE-1 ){    /*  表空间已满，不能插入*/
                      printf( " 表满 " );
                      return;
           }
           if (_____①_____) { /*检查插入位置的合法性*/
                     printf( " 位置不合法 " );
                     return;
           }
           for ( j = L->Last; j >= i-1; j-- )
                     _____②_____;    /*将 ai～ an 倒序向后移动*/
           L->Data[i-1] = X;      /*新元素插入*/
           L->Last++;                        /*Last 仍指向最后元素*/
           return;
}
```

2. Given the following function to pop an element out of a 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 IsEmpty(Stack S)
{
    return (_____③_____ );
}
bool Pop(Stack S)
{
    if(IsEmpty(S)){
        printf("Stack is empty!");
        return false;
      }else{
        return _____④_____;
      }
}
```

3. Given the following program to implement preorder 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 PreorderTraversal(BinTree BT)
{
    if(BT){
        printf("%d", BT->Data);
                                _____⑤_____;
        _____⑥_____;
      }
}
```

4. Given the following program to insert a new element into a binary search tree.

```
BinTree Insert( ElementType X, BinTree BST )
{
     if( !BST ){
```

```
            /*若原树为空，生成并返回一个结点的二叉搜索树*/
        BST = malloc(sizeof(struct TreeNode));
        BST->Data = _____⑦_____;
        BST->Left = BST->Right = NULL;
    }else   /*开始找要插入元素的位置*/
        if( X < BST->Data )
            BST->Left = Insert( X, BST->Left);
                        /*递归插入左子树*/
        else    if( X > BST->Data )
            _____⑧_____;
                        /*递归插入右子树*/
        /* else X已经存在，什么都不做 */
    return BST;
}
```

5. Given the following program to implement simple insertion sort.

```
void InsertionSort ( ElementType A[ ], int N )
{       /* 简单插入排序 */
        int i, j ;
        ElementType temp;
        for ( i = 1; i < N; i++ ) {
            _____⑨_____;            /* 取出未排序序列中的第一个元素*/
            for ( j = i;   (j > 0) && (temp < A[j–1]);   j-- )
                _____⑩_____ ; /*依次与已排序序列中元素比较并右移*/
            A[j] = temp; /* 放进合适的位置 */
        }
}
```

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

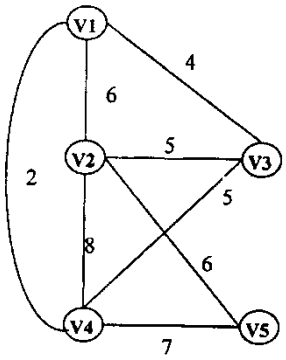
1. (7 points) Given a binary tree, the inorder traversal sequence is: cbedahgijf, and the postorder traversal sequence is: cedbhjigfa, please draw the binary tree.

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 A and D.

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 Shortest Path by Dijkstra's algorithm from vertex 1, please complement the list above.

过程 / 终点	=> 从v_0到各终点的D值和最短路径父顶点P的变化过程 =>									
	Step 0		Step 1		Step 2		Step 3		Step 4	
	D	P	D	P	D	P	D	P	D	P
v_2	6	0								
v_3	**4**	**0**								
v_4	2	0								
v_5	∞									

5. (7 points) Assume keys={29,1,13,15,56,20,87,27,69,9,10,74}, hash function is h(key)=key%17. The linear probing is used to resolve collisions. Please try to give the final hash table and calculate the average successful search length (ASL).